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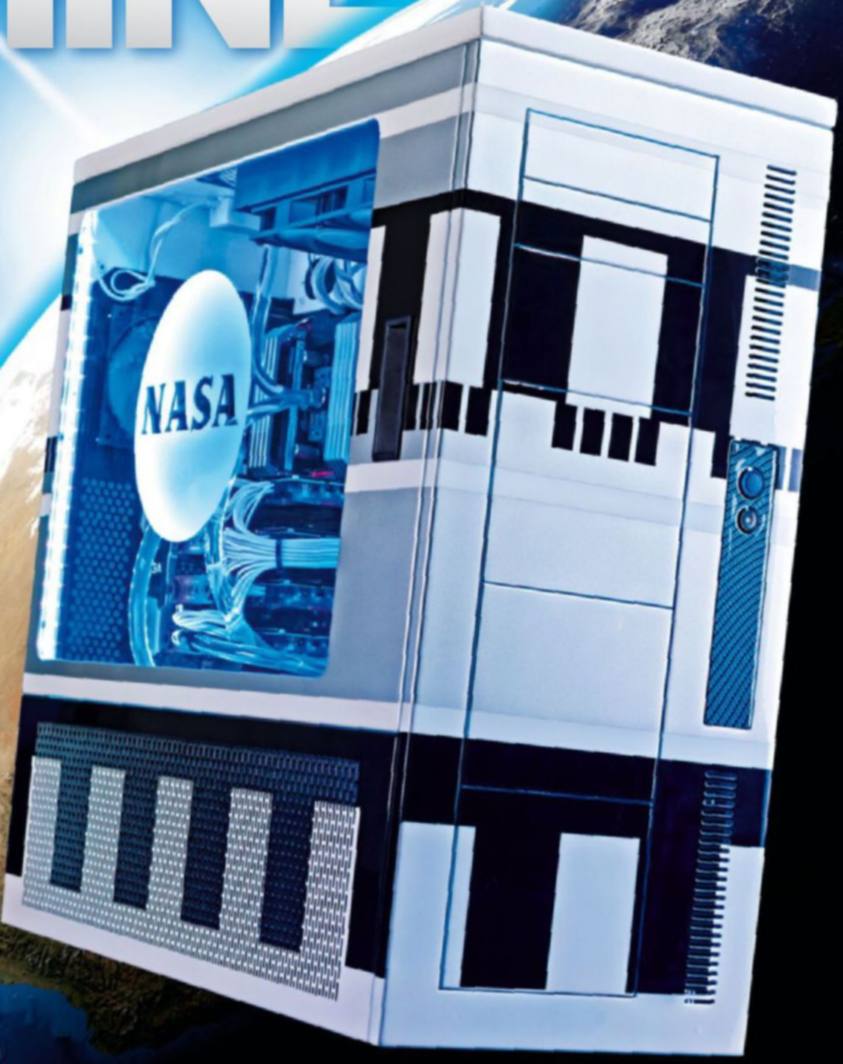

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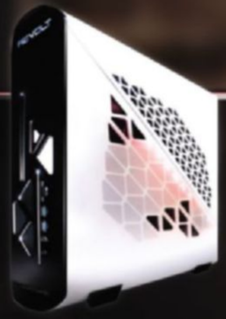

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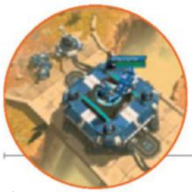

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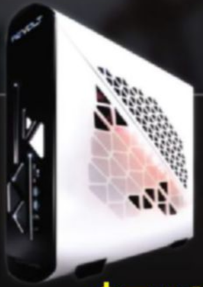

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Tuan
Nguyen

WHAT DREAMS ARE MADE OF

DREAM MACHINE. It's a term that sends chills down the spines of PC companies, as those that don't produce the very best stuff—and even some that do—get left by the wayside. There's just one Dream Machine per year, after all. So, every year, we put together a system that defies convention, where money is no object and the components are ludicrous. Our team joins forces in a ritual that lasts for a few weeks and only emerges when we've constructed an audacious creation of pure tech lust.

This year's Dream Machine focuses on performance at the primal level. There are no dual-platform heroics, just unadulterated performance. We went with the very best components available to us at the time of publishing. But that's not all. Every Dream Machine in recent years has been designed around a theme. This year, we're going with a NASA space theme, which is appropriate considering NASA just gave us the very first high-res shot of Pluto—in color, no less. But the really interesting part came in the form of the chassis we chose. The founder of the company we went with actually worked on NASA projects many years ago, and we didn't realize it until we had spent a lot of time talking with the people there. Talk about a serendipitous encounter!

Of course, as with any obscene system, everything we did was custom: custom paint, custom chassis, custom liquid cooling. However, there was one caveat. Due to time constraints and parts sourcing and wrong parts arriving, etc., we were unable to do hardline tubing for the custom cooling. We plum ran out of time. Despite that, it's still a beast of a system with two independent liquid loops separating the monster graphics cards and the overclocked CPU.

What's the best thing about this year's Dream Machine? If you want to, you can actually go out and build it yourself. We didn't use any proprietary parts and everything is available for purchase at any of your favorite outlets. That's the beauty of the PC; you can make it what you want and make it truly your own.

Dream Machine 2015 is my very first as editor-in-chief. It was a challenge for sure. Having the best components certainly helps beat the previous year's machine, but this was one machine where the entire staff unanimously drooled over the finished project. I'm truly proud of what we put together and the effort we put forth as a team. All of us here at *Maximum PC* hope you enjoy it as much as we enjoyed putting it together, then putting it through its paces.

We are often asked one question about Dream Machine: what happens to $21,325 worth of hardware after this? We were hoping that NASA would take it into orbit for some zero-gravity gaming action, but if it's not destined for the final frontier, then there's a nice empty space on my desk that would make a perfect landing pad. Yoink!

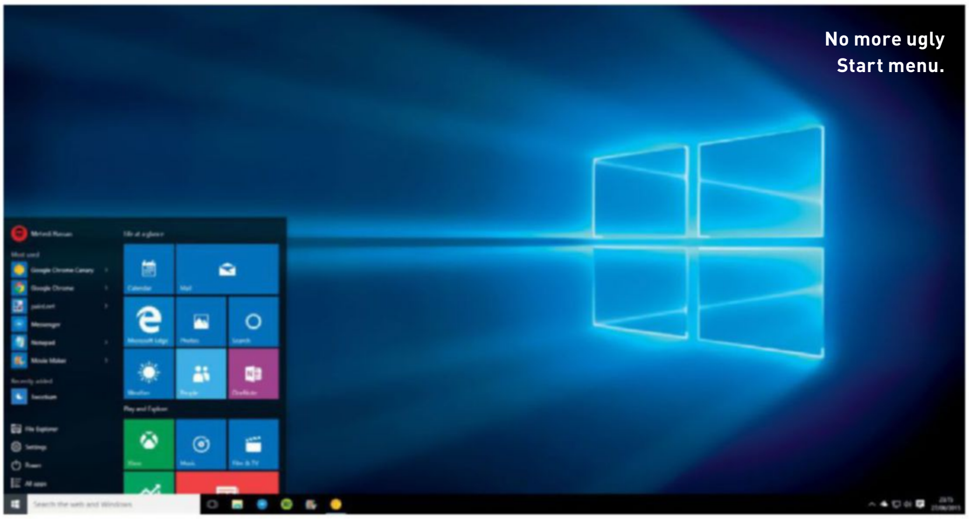
Tuan Nguyen is Maximum PC*'s editor-in-chief, also known as "the pointy end of the stick." He's been writing, marketing, and raising hell in the tech industry for 19 years.*

↘ submit your questions to: comments@maximumpc.com

THE NEWS

Windows 10 arrives; PC users rejoice

All the big changes you've wanted, and all for free


No more ugly Start menu.

THIS IS A BIG YEAR for the PC, but not because of any particular hardware release. Sure, there have been a few interesting component launches, but the one thing that ties them all together is Windows. Microsoft's long-running operating system is still the heart of the PC ecosystem, and it has improved gradually through the years.

Some would argue that in the last few years, Microsoft has made some glaring mistakes with Windows, focusing more on unwanted and unnecessary features than making actual structural improvements. The underlying layer of Windows has been the same for some time, including one pillar of the OS that most performance enthusiasts have been clamoring for: an updated version of DirectX.

Enter Windows 10. It's finally here. Microsoft has done a commendable job, this time, focusing on fine-tuning the base structure of the OS rather than trying to start revolutions. Out is the touch-based Start menu, which is one area that frustrated users the most. In are genuinely useful features that many will appreciate, such as universal apps that can be moved and used from one device to another.

For performance purists, the biggest feature is DirectX 12. With DX12, Microsoft has made huge changes that will impact the way applications communicate with your system's hardware. Microsoft is now allowing more direct access to hardware, without going through multiple software and API layers. App developers are hailing this as one of the best improvements to Windows in years. If you've picked up a graphics card within the last 12 to 18 months, expect it to be DX12-compatible, which should net you a good 15–25 percent improvement when you upgrade to Windows 10.

Aside from performance improvements, Microsoft also added other features that will increase your system's utility. Xbox streaming, for example, allows all Xbox One owners to play games on their desktop. Cortana is the smart virtual assistant that's supposed to be Microsoft's answer to Google Now and Apple's Siri. The last bit of major significance is universal apps.

With universal apps, Microsoft is hoping to scale up the development world in a big way. This will be Microsoft's glue to harmonize all types of devices. One app, multiple devices. The same version of Word that you run on your desktop will run on your Windows phone, and vice versa. No more developing multiple versions of the same app. This is a huge deal because it allows you to stay in sync, no matter how you switch up your devices.

Microsoft says that universal apps will be smart. In other words, a universal app will appropriately detect what kind of device you're using it on, and will then change its user interface according to the screen size and type.

There are users who still swear by Windows 7 because it's lightweight compared to Windows 8.1 and didn't come with the stigma that was the Windows 8 Start menu. But having tried out Windows 10 ourselves, we can confidently recommend you get on 10. Besides, Microsoft is making Win10 available for free for a year. Get it while it lasts. **–TN**

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HGST CRACKS THE 10TB BARRIER

SSDs ARE TAKING the world by storm, thanks to raw speed and a continual decline in prices. But HDDs still play a pivotal role in storage due to their sheer capacity. At some point, SSDs will probably surpass spinning disks in capacity and price, but until then, HGST's latest monster reigns supreme.

The company just announced a nerdalicious 10TB hard drive and we're dying to get our grubby hands on it. But this isn't a drive for mere mortals. HGST's Ha10 helium-filled drive is meant for large-scale enterprises that focus on active archiving. This means the drive is operating at all times, but with low IO. It's not meant to be a primary OS drive on your gaming desktop. In fact, it won't even work properly in your PC.

According to HGST, special requirements in the software stack—as in OS and drivers combined—are required to operate the Ha10's host-managed shingled magnetic record (SMR) writing technology. SMR writes magnetic tracks to the hard drive in the same manner as shingles on a roof are arranged. With traditional hard drives, tracks are packed next to each other, with closer and closer tracks on denser hard drives. The drawback is that the read/write heads need to be smaller, too, and this size reduction also cuts the magnetic field strength. SMR solves this by using wider tracks to maintain read/write head sizes and therefore strength, but solves the track density problem.

But what this all boils down to is that if you want one anytime soon, you're out of luck. You're going to have to wait a while longer for such ludicrous capacities to land on the consumer landscape. Plus, these babies are over $1,200 each. **–TN**

HGST
HelioSeal
HELIUM TECHNOLOGY
Enterprise-class
SMR HDD
10TB
Ultrastar Archive Ha10

It's so big that normal PCs can't use it.

The only thing worth considering is the controller.

STEAM MACHINES FINALLY GO ON SALE

BUT WHO CARES?

STEAM MACHINES are the brainchild of Valve, which brought you such titles as *Half-Life*, *Counter-Strike: Global Offensive*, and *Team Fortress*. It's never done hardware before, but it's getting into it in a serious way. Take, for example, Valve's virtual reality system that's being produced with HTC. Some say its setup is even better than what Oculus has created.

One might think a company with the most cutting-edge VR system would nail other hardware endeavors, right? Nope. After three years of hype and waiting, Steam Machines are finally on sale with the much-talked-about Steam controller. But we have to ask: why bother? They're just regular PCs you could build yourself. And if you run Windows, you can play all games, not just Steam OS games. **–TN**

RAZER BUYS OUYA... OR DOES IT?

Resurrection or nail in the coffin?

AFTER AN ILLUSTRIOUS KICKSTARTER CAMPAIGN IN 2012, in which it raised more than $8 million, Ouya, the company behind the $99 Android gaming console, fell into a well. The hackable-console firm lurched from setback to setback, with the situation seemingly coming to a head in April. A leaked memo from Ouya CEO Julie Uhrman reportedly suggested the company was struggling to restructure its debt. Put simply, it was in desperate need of a buyout. But now, it seems, there may well be hope. Well, maybe.

Investment bank Mesa Global announced, but then swiftly retracted, news that it had brokered a deal with Razer. No details were given, and no confirmation has been forthcoming from Razer, which has its own Android console, Forge TV, despite no shortage of opportunity at E3.**–TN**

Tech Tragedies and Triumphs

A monthly snapshot of what's up and down in tech

TRIUMPHS

SAMSUNG GOES BIGGER
The insanely huge 2TB rendition of its blisteringly fast 850 Pro SSD hits the shelves (review on page 80). Wallets everywhere weep.

AR IN SPACE
NASA and Microsoft take HoloLens into space for "scientific" purposes. Sure, we believe that. *Minecraft* in space is more like it.

DUDE, WHERE'S MY iCAR?
Apple poaches Chrysler's head honcho of quality to help with its electric car project.

TRAGEDIES

HACKERS CLAIM MORALS
Cheating and casual sex site Ashley Madison gets hacked, purportedly for being "immoral," exposing the private data of 37 million people.

BREAKING MOORE'S LAW
Intel says its schedule for new CPU tech is now more along the lines of 30 months instead of 24 months.

SOUND AND FURY
AMD's new flagship GPU, the Fury X, has some cooling issues—in the form of excessive pump noise. AMD promises to fix the issue.

Tom Halfhill

FAST FORWARD

Wireless Charging = Wireless Waste

IMAGINE HUGE transcontinental airliners powered by wireless energy, cruising the skies unburdened by bulky fossil-fuel tanks. Such a future was imagined for 1985 in the science-fiction novel *Haunted Airways*, published in 1937. Instead, 1985 brought us Cherry Coke and Madonna's "Like a Virgin."

Thirty years later, we still don't have those fabulous, wireless-powered airliners. But we're getting Wi-Fi in coach class, so at least there's some progress. My point is that wireless energy has been a futuristic dream for a long time—in fact, since the days of Tesla (Nikola, not Musk). The latest manifestation is wireless charging for our battery-powered gadgets.

This technology began appearing at least 10 years ago. Although much has happened since then, I'm still a skeptic. Oh, sure, it works. Some mobile phones have built-in power receivers that communicate with wireless charging pads or cradles. You can just plop your phone on the pad and let it recharge overnight, without ever fumbling with a USB cable.

Two problems. First, even after 10 years, the industry still can't agree on a universal standard that enables any phone to work with any wireless charger. In fact, more variations keep coming. And some are radically different, so they aren't easily merged. The second problem is that wireless charging wastes energy and probably always will. Air is simply a less efficient conductor than copper. (It's a blessing. Otherwise, life would be electrifying.)

> Two-thirds of the energy input disappears into the ether. And it isn't free. To me, that inefficiency is a high price to pay for replacing a cable.

One of the latest wireless-charging systems is a big departure from the conventional inductive systems now vying for adoption. An Israeli startup, Wi-Charge, is using mirror-guided infrared lasers to transmit power at distances up to 30 feet. The transmitter focuses the laser on a receiver that has a concentrated photovoltaic cell, which converts the beam's photons into electrons. Basically, it's like shining a flashlight on a solar panel. Light goes in, electricity comes out.

Of course, even the wildest Greenpeace hippie wouldn't propose generating electricity this way. The flashlight batteries would consume far more energy than the solar panel would generate. But practicality is no obstacle when consumer convenience is the goal. Wi-Charge says its laser system is 35 percent efficient, which means it's 65 percent inefficient. Two-thirds of the energy input disappears into the ether. And unlike the sun's energy, it isn't free.

To me, that inefficiency is a high price to pay for replacing a cable. A million users here, a million users there, and pretty soon we're talking about real megawatts.

Let's be fair to Wi-Charge. Its laser system is a clever invention for some applications. For example, fire alarms, surveillance cameras, and wireless speakers are often located in hard-to-reach places where AC power isn't readily available. And the company appears to be taking the necessary safety precautions by using low-power Class 1 infrared lasers that won't accidentally burn holes in objects or people who pass through the beam. (The transmitter and receiver require a clear line of sight.)

I'm less enthusiastic about charging mobile phones this way, though. Are we really too lazy to plug in a cable? Even with a wireless charger, the phone is immobilized while it's charging, so tethering isn't a severe hardship. The only arguable advantage is there's no cable to misplace. That's progress, I suppose. But it probably wouldn't inspire a 1930s science-fiction writer.

Charging...
75%

With 65 percent of energy wasted, wireless charging has a way to go.

Tom Halfhill was formerly a senior editor for *Byte* magazine and is now an analyst for *Microprocessor Report*.

CyberPower recommends Windows.

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Work easy. Play hard. Windows

Alex Campbell

OPEN SOURCE

Why The Government Must Go Open Source

IN APRIL, it was discovered that the personal data of over 21 million US citizens was stolen from the Office of Personnel Management. I'm one of those people, and I'm pissed off.

There were lots of systemic lapses in security that led to the OPM break-in (I won't go into detail, for sake of blood pressure), but this is an opportunity to reevaluate how we approach public sector computing. There's no better kind of software for public institutions than free and open-source software (FOSS) when it comes to civic engagement, security, and sovereignty.

Oh, did I mention it can save money? Regardless of affiliation, too many people feel the government is separate from themselves. They feel they have no voice, no way to make things work better. Call me crazy, but I believe government and public life is what we make of it. Code for America recruits coders and assigns them to cities or states to help develop applications. Like Americorps for programmers. But CFA faces the problem of convincing coders to work for half or less than what they'd make at some startup. That's a lot to ask of someone with a San Francisco apartment and a Tesla payment. (Look up rents in the Bay Area, I'll wait.)

As much as I love what it does, Code For America can't do everything itself. Governments don't know how to, and sure as hell can't afford to do it on their own, either. With FOSS, citizens would have a chance to directly improve their communities by contributing code. Governments could draw upon their citizens' talents to create effective (and less costly) services. It's civic engagement for geeks.

But what about security? Open-source projects can be quite nimble when it comes to vulnerabilities.

> “Citizens could directly improve their communities. It's civic engagement for geeks.

AD

Seriously guys, you're still using XP?

As the saying goes, security through obscurity is not security at all. When the Heartbleed bug was announced in April, a patch for OpenSSL was available the same day. It's no secret how public key cryptography works, and anyone can get the source code for PGP or ciphers like Twofish or AES. But magically, nobody has broken OpenPGP. How can that be?

Anybody can audit or fix FOSS projects because (duh) the source is available to everyone. Everyone can see the bugs, and anyone can fix them. The fear of contributors introducing backdoors is mitigated by auditing and reviewing code before it is merged into the main branch of a program.

Free projects protect sovereignty too, by removing the need for license payments and allowing modification. There's no need to pay for extended support of an obsolete system. (The OPM still has rigs running XP.) Despite this, several governments may undermine their own interests. After Wikileaks published the text of the Trade in Services Agreement (TISA), the Free Software Foundation (FSF) condemned the proposed agreement's electronic services annex: "Ensuring that government-used and -purchased software is free for anyone to review, share, and modify promotes the safety and security of the people," it said.

Any government that uses proprietary software is subject to the whims of a non-state actor and that of its home government. That is not acceptable for any sovereign state. A government that uses FOSS, meanwhile, will not be crippled by an unaddressed vulnerability, company failure, or corporate whim. It will be more secure, healthier, and more free.

Alex Campbell is a Linux geek who enjoys learning about computer security.

THE LIST

9 OCULUS RIFT GAMES WE PLAYED AT E3 2015

LUCKY'S TALE This cute third-person platformer starring a squirrel aims to fill your VR Mario itch.

HEROBOUND: SPIRIT CHAMPION You play as an elf in this third-person hack-and-slash fantasy.

EVE: VALKYRIE Dogfight your way through the universe in your very own spaceship.

ESPER This first-person game has you solving puzzles and manipulate your environment with ESP powers.

DAMAGED CORE An FPS sniping game, in a *Tron*-like futuristic setting, with quite a deep learning curve.

CHRONOS A third-person action-adventure title clearly influenced by *Zelda* and *Ico*.

AIRMECH VR Take control of a transforming jet/mech in this top-down strategy game.

VR SPORTS: CHALLENGE Aiming to be VR's Wii Sports, it'll feature basketball, football, and hockey.

EDGE OF NOWHERE Take one part *Tomb Raider*, mix in a frozen tundra, and add some Lovecraftian horror.

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TALKING

BY **JIMMY THANG**

Consumer VR Within Touching Distance

MPC chats to Oculus VR founder Palmer Luckey

It feels like we've been waiting forever for the consumer launch of the Oculus Rift virtual reality headset. But the wait is almost over. We bumped into its inventor, Palmer Luckey, at E3, so sat him down to ask about release dates, gamepads, and the Touch controller.

Virtual hands will feel like *actual* hands with Touch, says Luckey (right). Read our hands-on, on page 93.

Maximum PC:
What's E3 been like for you?

Palmer Luckey:
It's been really good. We're here at E3 showing the final version of the consumer Rift. It's going to be shipping to gamers and enthusiasts everywhere in Q1 2016. We're going to be opening up preorders later this year.

We've also been showing Oculus Touch, which is our six-degrees-of-freedom 3D-motion controllers. You're going to be able to preorder those around the same time as the Rift. And it will be shipping a little after the Rift. We're also showing off nine different titles that we've been working on with studios like Insomniac and High Voltage.

MPC:
Do you have a more precise date?

PL:
There is a date in mind, but right now we're just saying Q1. We'll let everyone know when we start taking your money!

MPC:
And the Oculus Touch controller is coming in the first half of the year. Is that correct?

PL:
Yeah, that's correct. It'll be coming in the first half of 2016, probably just a little bit after the Rift ships.

MPC:
You said you worked on the controller aspect of the experience. Does it kill you that you can't ship it together?

PL:
It's not that we can't ship it together—we could do that—it's a decision I'm totally behind. We've been working with a lot of developers for over a year, some of them even going back two years working on their VR content. And almost all of that content is built around gamepads, and that's just the reality of what's been available in the VR space.

They're the genres people have been building games for, whether it's driver simulators, space fighter simulators, or platformer games. And so one of the most common requests that devs had for us was, "please make it so that every person who buys the Rift is able to play my game without buying any additional hardware." So, it's not a huge cost to add a gamepad to

Say goodbye to the dev kits. Oculus VR's consumer headset and gamepad ships in Q1 2016.

the Rift's bundle. It made sense to add it, so devs could be confident that they would be successful if they targeted that gamepad.

But we are shipping Touch shortly thereafter, so that for those types of experiences that are out there, people are going to be able to do those. Devs are going to start working on them. But it's going to take time, to get experiences for motion controllers that are as polished as the ones for gamepads.

Gamepads have decades of work behind them with known genres. People know how to make them work for driving and flying and platforming. Motion controller people don't really have as much of a good idea. So it's going to take months, maybe even a couple of years, before we see games that are as polished as the gamepad-based games.

MPC:

We know the prototype controller is code-named Half Moon. Is it final or beta?

PL:

It's pretty close to final. There's a few tweaks we're making in the design, but what you see is largely representative of what we're going to be shipping next year. There's a few features we haven't shown in the software that we're showing off at the show, so there's going to be like some industrial design changes, some slight ergonomic changes, a couple of tweaks on the features. What you're seeing at the show is about what you're going to get.

MPC:

Can you walk us through what the controller is like?

PL:

Touch is a controller that we designed to make it feel like your virtual hands in the game are actually your real hands. We didn't want to feel like you were manipulating a tool or a wand in the game, so we've designed it to be extremely ergonomic, with your hand in a resting position when you're holding it.

It has a loop around it that's used for tracking, but also to make the center of gravity right in the center of your hand. So that when you're moving around, you can feel inertia like you're holding a stick or a sword, rotating about the central point of your own hand. It has sensors in it that allow us to, in addition to tracking the position and orientation of your hand, track the movement of your finger, so I can track if I'm pointing at you or giving you a thumbs up. I can flick things.

That makes a huge difference in the experience, compared to what you can get from most other tracked controllers. We've also integrated some traditional inputs. We've got two buttons, a couple of triggers, and also an analog stick.

MPC:

Some people are worried about fragmentation. Are you guys concerned about that?

PL:

Fragmentation is somewhat inevitable. The way we look at is, "what is the best thing we can do for our game developers and our game consumers." And what would be a lot worse than any kind of fragmentation would be saying, "hey, all you game devs who've been working years on gamepad games, that's not going to work, we're actually going to ship with a totally different input." I mean, that's the type of thing that really leads to fragmentation.

You saw a lot of blowback from developers when Microsoft stopped bundling Kinect with the Xbox One, for example, because they had been relying on that being part of the bundle, and going back on that can put devs in a real bad scenario. There was always going to be fragmentation. It's not like if we bundle the controllers, every game was going to use Touch.

For a lot of games, it doesn't even make sense to use Touch, a gamepad is going to be the better input. For example, *Eve: Valkyrie*, our platformer game. It's more comfortable to have a two-handed controller that you can use for operating analog sticks, and a bunch of complex inputs and buttons at the same time. We weren't trying to make Touch a perfect universal controller for every type of game.

MPC:

Up until Valve announced its motion control system earlier in the year, it was like the Wild West of input for virtual reality. Have you guys done a lot of testing? Have you done any really weird oddball stuff?

PL:

We've experimented with everything. We've done gloves, we've done strapons, we've done gamepads, we've done things that split apart, things that transform. We've tried almost everything you can do on a gamepad, trying to figure out what we were going to do. It's never going to be the best.

If your number one thing is tracking fingers and their perfect movement, then a glove or a computer-based vision-tracking system would be better. If you're doing a racing game, obviously Touch isn't going to be the best way to do that, it's going to be with a real steering wheel. There's no perfect input for all games, but I think Touch is the right set of compromises that will result in the best overall trade-offs between a wide variety of different games.

MPC:

Could we one day see Oculus package the Rift and the Touch together? Is it always going to ship with the controller, or is it too early to tell?

PL:

We're not ruling it out, but right now we're focused on launching the Rift with the Xbox One gamepad, because that is what most of our launch titles are supporting, and a lot of the titles going into 2016. We're investing a lot of content into Touch as well, so we're helping developers start making games with that. Right now it makes most sense in bundling the gamepad. ⏻

DOCTOR

THIS MONTH THE DOCTOR TACKLES...

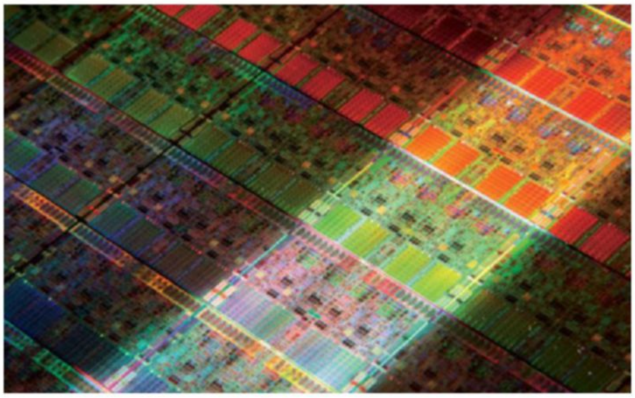
>The Silicon Lottery
>Hooking Up 4K
>First-Ever Build

SSDs in RAID

Hi Doc. I recently replaced my four 300GB Western Digital Raptors in RAID 0 with two Samsung 850 EVO SSDs, also in RAID 0. My C:/ drive is a 256GB Samsung 840 Pro on which Windows 8.1 Pro resides. The EVOs are drive D:/. Samsung's Magician software came bundled with the EVOs. But when I use it, the program only sees the 840 Pro. There's no D:/ drive at all. Now, when I go into Windows's Device Manager, under Disk Drives, I see the 840 Pro. However, the other drive is listed as an Intel RAID 0 volume. Why can't the striped volume be identified as the 850 EVO SSDs? Is there a way to get them properly identified by Windows, or seen by Magician? Is this going to hurt the drives when Windows defragments them? They are fast; the performance seems to be there. I have tried to update their drivers, but Windows says they're already up to date. I hope you can help.

—Ron Shibler

THE DOCTOR RESPONDS: Unfortunately, Samsung's Magician software will not recognize SSDs in RAID, as you've observed, Ron. However, consider installing Intel's Rapid Storage Technology driver, which does support your drives in a striped array.



CPU dies are cut from a large wafer, and some variability is inevitable. Winning the "silicon lottery" can be interpreted as coming home with a particularly strong sample.

Fast as a Thunderbolt

Please help. I want to build the best and fastest Thunderbolt motherboard (to which I plan to connect an Apple display). What's your view on the Asus X99-PRO/USB3.1? What CPU would you recommend? How much RAM?

—Heather Ravenelle

THE DOCTOR RESPONDS: To be honest, the Doc hasn't had a chance to use the X99-PRO/USB3.1. As a result, he's limited to Asus's compatibility list and any helpful hints the company might provide. Visiting the ThunderboltEX II information page suggests the X99-Deluxe and X99-Deluxe/U3.1 are Asus's only two validated X99-based models. However, the X99-PRO/USB3.1 has the same Thunderbolt header, so there's no reason it shouldn't work as well. While that's not a glowing endorsement, if you're brave enough to fiddle with the Thunderbolt Display under Windows, living on the edge might not be an issue for you.

It's difficult to make specific recommendations without more information about what you want to do with your new PC, Heather. If you only need one graphics card, the Core i7-5820K's value as an easy-to-overclock six-core powerhouse can't be denied. Twenty-eight lanes of PCIe connectivity might not be enough though, in which case the 5930K buys you another 12. And if eight processing cores make a difference to your application, then the Core i7-5960X is in a league shared only by Xeon CPUs. Wrap the build up with 16 or 32GB of DDR4 memory in a quad-channel configuration.

Time to Upgrade?

Hello Doc! I've been wondering how much longer my systems will hold up against all of the new games/software out there. Back in 2011 and 2012, I built two desktop PCs. Both are running on LGA 1155 interfaces. They're almost identical except for their CPUs. One has an Intel Core i7-2600K (Sandy Bridge) quad-core processor, while the other has a Core i7-3770K (Ivy Bridge). Each machine has 32GB of DDR3-1600, Mushkin 240GB SSDs, and a Gigabyte GV-N970G1 GAMING-4GD GeForce GTX 970. How much longer will these systems be able to run today's games at max settings? We're currently playing *MechWarrior Online* and *Elder Scrolls Online*. With all of the CPU power available now, would it be best to upgrade soon, or do I still have a few years of great gaming in store?

—Robert Klaas

THE DOCTOR RESPONDS: You're being modest there, Robert. Those were the fastest

↘ submit your questions to: doctor@maximumpc.com

CPUs available when the Sandy Bridge and Ivy Bridge architectures launched. And if we're being honest, Intel didn't improve host processing performance much from one generation to the next (that includes its Haswell and Broadwell efforts, by the way).

On top of that, you're rocking tons of memory, speedy SSDs, and some of the fastest single-GPU graphics cards available. It helps that the games you're into aren't resource hogs. The Doc is missing a bit of information, though. What resolution do you game at? Do you have an urge to see what 4K is all about? Do your motherboards support two-way SLI, at least?

More than likely, those two machines will serve you well for another couple of years. If you start noticing slow-downs at maxed-out settings, suspect your graphics cards first. Fortunately, adding another GTX 970 is a lot cheaper than starting from scratch.

Winning the Lottery

Hi Doc, I'm new to PC building and have been trying to do my due diligence before tackling my first build. It'll mainly be for Adobe Premiere Pro, Photoshop, and a bit of IC layout design. I've decided on an X99 motherboard (haven't picked the board yet; your recommendations are welcome), a Core i7-5820K, a GTX 980, 32GB of DDR4 memory, a 1,000W PSU, and a water-cooling setup. This might be overkill, but I'd like a machine to last for three to five years without choking on Adobe's ever-increasing hardware requirements.

I keep hearing the term "silicon lottery." Is there any legitimacy to this expression? Could this variability be the result of installer error rather than manufacturing issues? I plan on using an anti-static wrist strap and mat like most people. But one other thing stuck out in my mind that I can relate to in my field of work. I'm a high-end Italian car mechanic, and I know from experience that, as an example, if you install a lightbulb with your bare hands, skin oils will get onto the glass and create a hot spot that will shorten the life of the bulb. The cure is to wear latex or nitrile gloves. Could this same phenomenon be affecting component installations? I also know that over 80 percent of engine failures or shortened life spans after a rebuild are due to a contaminated environment. From what I've read, manufacturers use clean rooms, so the rate of failure people report with the silicon lottery seems suspicious.

—Spencer

THE DOCTOR RESPONDS: Winning the "silicon lottery" is less about defective or damaged components and more about finding that one CPU or graphics card that overclocks above and beyond any enthusiast's expectation.

A processor composed of hundreds of millions of transistors in a few hundred square millimeters of area is mind-bogglingly complex. There will always be some variability involved in the manufacturing process, and the companies selling those chips do an admirable job of sorting them out into actual products.

Now, you're only guaranteed the specifications promised on the box. On your Core i7-5820K, for example, that's a base clock rate of 3.3GHz, and a maximum Turbo Boost frequency of 3.6GHz. Let's say a majority of 5820Ks make it to 4.5GHz with all six of their cores active. A particularly special example might be stable at 4.7GHz under the same conditions. The owner of that processor would be said to have won the silicon lottery.

As far as the projected specs for your first build, that should be a well-balanced system. The GTX 980 might be considered overkill for the tasks you mentioned. However, the Doc assumes you'll do a little gaming, too. Oh, and he didn't see any mention of storage. Be sure to snag an SSD with enough space for your OS and those performance-sensitive apps inspiring this project!

This Gigabyte GPU has three DisplayPort outputs, one HDMI port, and two DVI connectors. Stick with DisplayPort to hook up a 4K screen at 60Hz.

The 4K Connection

I recently purchased an Acer 28-inch B286HK 4K monitor and am wondering what type of cable I should use to hook it up to my GPU. I seem to remember articles describing restrictions depending on whether I used DVI, HDMI, or VGA. My videocard is a Gigabyte GeForce GTX 970 installed on an ASRock X79 Extreme4 motherboard with a Core i7-4930K and 16GB of memory. I'm looking to purchase a second GTX 970 at some point in the future for SLI.

—Roland Sauer

THE DOCTOR RESPONDS: Good call on the second 970, Roland. One GTX 970 won't be fast enough for most games dialed up to their highest settings. A word of caution, though: a very limited number of today's titles need more than 4GB (alright, it's mostly just *Grand Theft Auto V* at this point). But you can see where the industry is headed, right? The fact that 512MB of the 970's 4GB on-board memory is much slower could affect performance in situations when the RAM runs out.

Enough alarmism, though. You asked about a monitor cable. Without question, use the B286HK's DisplayPort interface. There's a cable included in the retail package, so making the connection with your Gigabyte card should be easy. Going with DVI or HDMI instead will either result in a resolution lower than 3840x2160 or a refresh rate below 60Hz.

Salvaging Old Parts

I've never built a PC, but would like to experience the feeling of accomplishment that I'm sure comes from such a project. After hitting up yard sales this past spring, I picked up a couple of used machines (an old Compaq and an eMachines box). Are there motherboards that would work as the foundation for a practical system, given my lack of experience and old hardware? I'm not looking to game. Rather, I just want to bring new life to an old PC. I could use a system that supports TV tuning and video editing. I don't even need much storage. However, a motherboard able to accommodate a CPU upgrade would be nice. I was thinking about going with EVGA's X99 Micro and Intel's Core i7-5930K. If that's overkill for an old eMachine case, could you set me straight? **—Jo Shmo**

THE DOCTOR RESPONDS: There are plenty of ways to compromise and save money as you collect the pieces for your first PC. But if you're in the market for an $800 processor and motherboard combination (that's before getting into the memory, graphics, and storage to balance those high-end parts), don't waste your time trolling yard sales.

It's not that the Doc has something against recycling decrepit hardware. He's simply trying to save you the trouble of getting elbows-deep into a chassis that might not even give your Core i7 ample airflow, only to discover it also uses non-standard dimensions that are unfriendly to modern ATX power supplies and microATX motherboards. With so many snazzy cases selling for less than $100, give those high-end parts a home you'll be proud to gaze upon.

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HIGH-PERFORMANCE PCS
NVIDIA GEFORCE GTX
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DREAM MACHINE 2015

In 1966, the Titan II GLV launched Gemini 11.

TO BOLDLY GO WHERE NO DREAM MACHINE HAS GONE BEFORE. Last year, we said we'd need to build this year's Dream Machine in space to beat our 2014 überdesk PC. So that's what we did, sort of. This year's Dream Machine is upping the ante by going out-of-this-world with a NASA motif. Specifically, we're modeling it on NASA's iconic Titan II Gemini Launch Vehicle, from the 1960s, which was powered by Titan II missiles. Dream Machine 2015, coincidentally, is powered by Titan rockets of its own. Four supercharged Titan X GPUs, to be precise.

We mainly went with this theme, though, because we think NASA and its space programs are cool. Really, who doesn't? Historically, NASA has been known for giving mankind a cutting-edge glimpse of the future of technology and innovation—topics that Dream Machine tries to evoke each and every year. The space program also embodies the spirit of what it means to dream big. It's the perfect theme for this year's Dream Machine.

Unlike the computers that powered the Titan II GLV, however, our Dream Machine is orders of magnitudes more powerful than all of the command centers on Earth back in the '60s, as you'll discover in the following pages.

So, strap yourself in and prepare to be jettisoned into the final frontier of computing! –MAXIMUM PC STAFF

NASA

STELLAR COMPONENTS

IF MONEY WERE NO OBJECT, what would the best PC look like? It's a question that Dream Machine has always tried to answer, and this year's build is no different. We've filled every PCIe, RAM, and SATA slot possible with the highest-grade components that we could find. Make no mistake, this PC has enough horsepower to reach relativistic speeds.

INGREDIENTS

PART		PRICE
CPU	Intel Core i7-5960X	$1,050
Mobo	Asus Rampage V Extreme	$470
RAM	64GB DDR4 Corsair Dominator	$1,495
GPU	4x EVGA GeForce Titan X Hydro Copper	$5,200
SSD	4x Samsung 850 PRO 1TB	$2,560
HDD	4x WD Black 6TB	$1,200
Cooling	EKWB custom-loop cooling	$450
Case	CaseLabs Magnum SMA8	$520
Paint	Smooth Creations	$800
OS	Windows 8.1	$100
Monitor	Dell UltraSharp UP2715K	$2,500
Mouse	Logitech Daedalus Apex	$70
Keyboard	Razer BlackWidow Chroma	$170
Headset	Kingston Hyper X Cloud II	$100
Speakers	Adam Audio 5.1 System	$3,700
Sound System	Sound Blaster X7	$400
LED Strips	Logisys RGB LED	$90
PSU	EVGA SuperNOVA 1600	$450
Total		**$21,325**

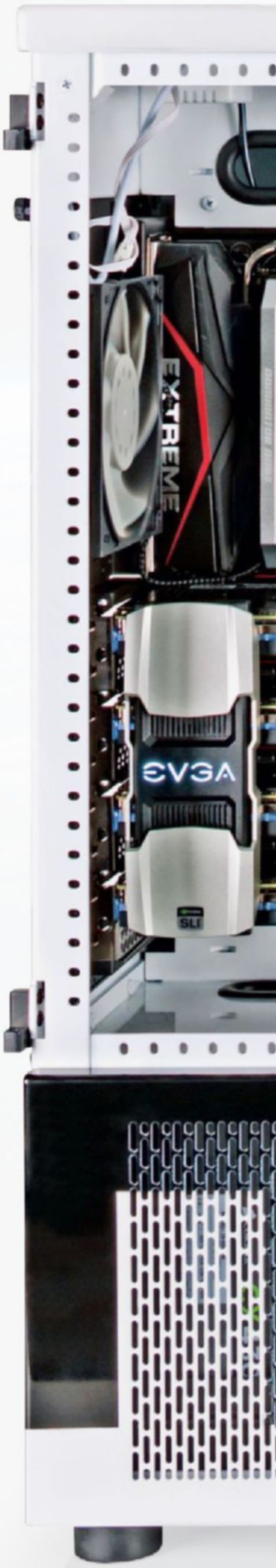
1 **GPUs** We grabbed the single fastest graphics card on Earth, Nvidia's GeForce GTX Titan X. And then we grabbed three more and put them into SLI. Oh, did we mention that they're all liquid cooled and heavily overclocked? Hell, yeah.

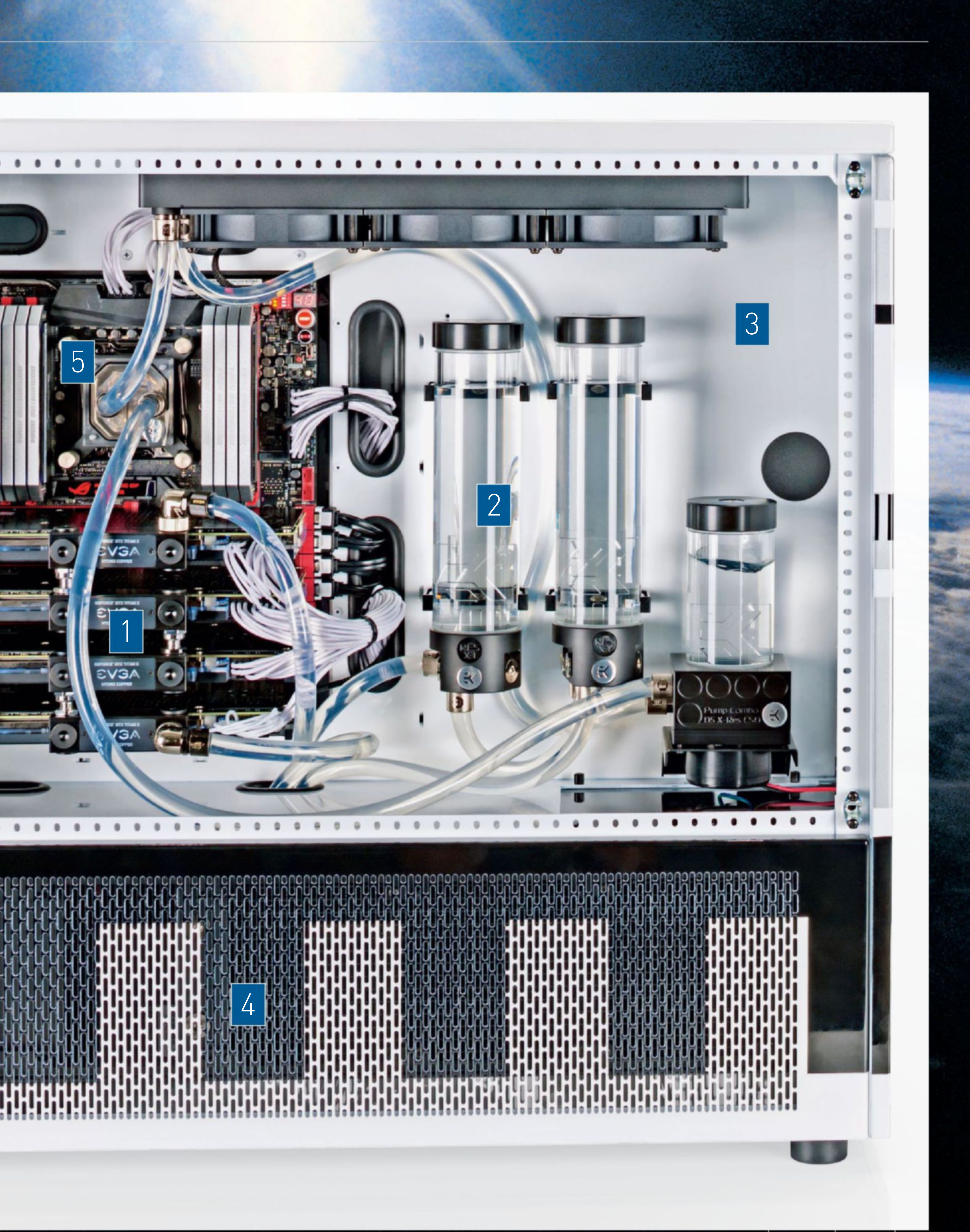
2 **WATER COOLING** Allowing our rockets to run at full capacity is our liquid-fueled custom dual-loop system from EKWB. This will ensure that our engine and rockets don't overheat when we break the sound barrier.

3 **STORAGE** You want hard drives? We've got four 6TB beasts mounted on the other side of the case. There's enough storage here to last us years in outer space. They're perhaps only eclipsed by our four 1TB Samsung 850 Pro SSDs that we've put in hyperdrive RAID 0.

4 **CASE** CaseLab's Magnum SMA8 is an astronomical chassis that's equipped to carry all the cargo that we need to send our Dream Machine into outer orbit and back. It's also got a super-sexy paint job from Smooth Creations.

5 **CPU** The central processing unit behind our rocket is Intel's Core i7-5960X, which is the most advanced CPU that money can buy as of this writing. It's got eight core engines, which we've boosted all the way to Mach 4.5GHz speeds.

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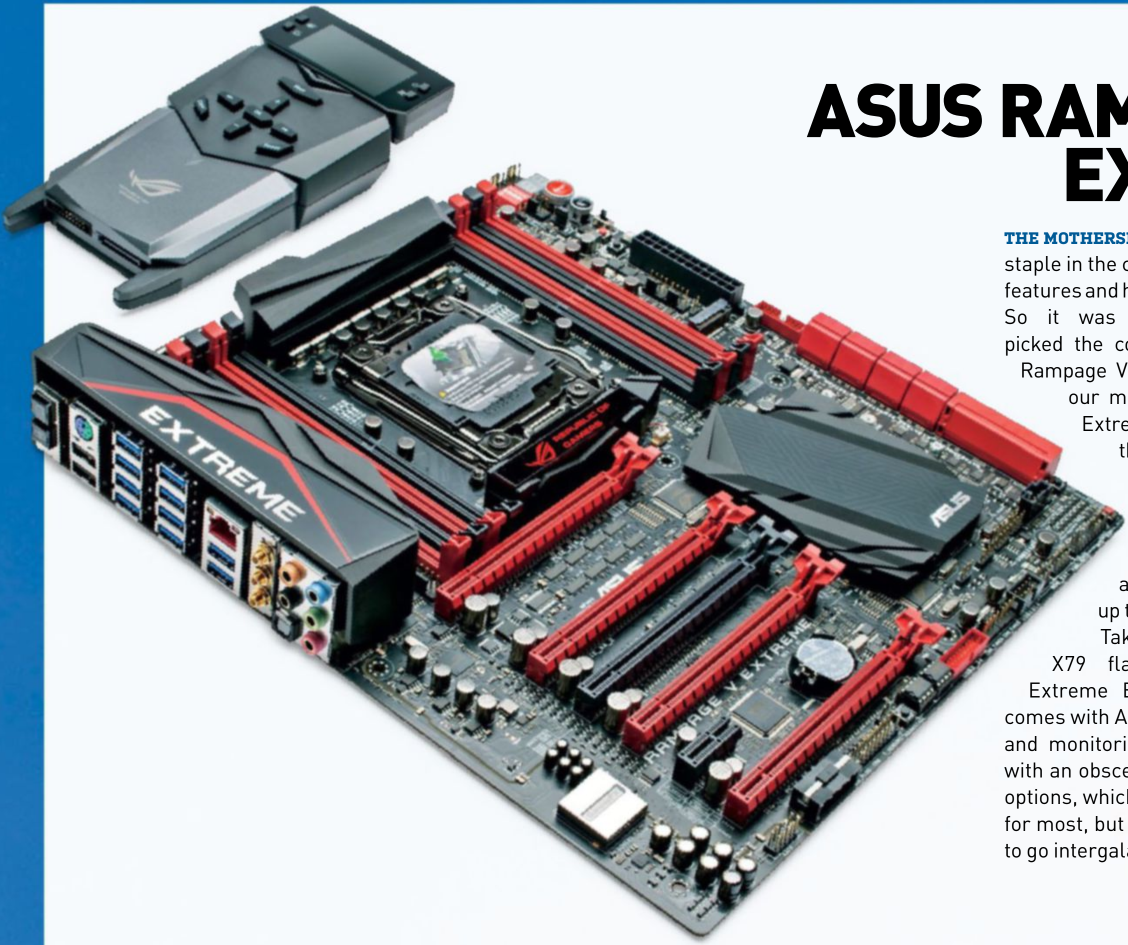

Mobo

ASUS RAMPAGE V EXTREME

THE MOTHERSHIP. Asus has always been a staple in the community for cutting-edge features and high-quality manufacturing. So it was a no-brainer when we picked the company's new highest-end Rampage V Extreme motherboard for our mothership. The Rampage V Extreme comes packed with all the features you'd expect from a flagship mobo: There's enough PCIe slots for a ridiculous four-way SLI setup, eight RAM slots, and overclocking features up the wazoo.

Taking a page from its previous X79 flagship—the Rampage IV Extreme Black Edition—the new V comes with Asus's external overclocking and monitoring module. It also comes with an obscene amount of overclocking options, which may be too overwhelming for most, but gives us enough headroom to go intergalactic.

Monitor

DELL UP2715K 27-INCH 5K

WE'VE GOT VISUALS. With all that rocket fuel, you can pretty much go anywhere you want. So we decided to shoot for the stars and go with a 5K monitor. Yep, that's right, because 4K is so 2014. With Dell's 27-inch UP2715K, we're rockin' a 5120x2880 Ultra HD resolution. That means we're pushing over 14 million pixels here, folks. In case you were wondering, that's roughly as sharp as seven 1080p panels; that's a lot of polygons we're pushing!

It might even be sharp enough to cut our retinas, if we weren't wearing our space helmets, of course.

If you're thinking this is a TN panel, think again. Dell employs an IPS display here and it's glorious. Seriously, the viewing angles and color reproduction are just stellar.

UNITED STATES

INTEL CONFIDENTIAL
QFRA ES 3.00GHZ
COSTA RICA
3413B932
2W413004A0727
R3

CPU

INTEL CORE I7 -5960X

THE BRAINS BEHIND THE OPERATION. Engineered by Intel, the central processing unit inside our rocket is the high-end, eight-core i7-5960X. Based on the 22nm process and clocked at 3GHz, this CPU turbos up to 3.5GHz. For DM2015, we can use all the power we can muster, so we fired our engines up to 4.5GHz speeds. The CPU also has 16 threads, a 140-watt TDP, and 20MB of L3 Cache.

For all-around computing and gaming needs, there's no better CPU out there at the moment. The 5960X is almost tailor-made to allow us to break the benchmark (and sound) barrier.

GPU

4X EVGA GEFORCE GTX TITAN HYDRO COPPER IN SLI

TURBO-INJECTED ROCKETS. One Titan X will run you about a thousand bucks. One water-cooled Hydro Copper Titan X from EVGA will cost you $1,300. Because this is Dream Machine, we, of course, set our sights on four of the Hydro Copper editions and put them in SLI.

Normal Titan Xs carry GPU base clocks of 1,000MHz and boost clocks of 1,075MHz, but these Hydro Copper editions carry a base overclock of 1,152MHz and boost clocks of 1,241Mhz.

We then overclocked them some more, leaving us with final clocks of 1,207MHz base and 7.7GHz on the GDDR5. When you also factor in the 12GB of VRAM and 3,072 CUDA cores, you'll see that we've got enough turbo-injected rocket power here to take us to the Moon and back. A few times.

RAM

64GB CORSAIR DOMINATOR PLATINUM

RAMMING SPEED. Ensuring that we're all packed up for the long haul, we used every RAM slot that we could. This meant plugging in all eight of our DIMM slots for a total of 64GB of RAM. And the Dream Machine doesn't pack any old cheap-o memory, oh no.

We've outfitted our rocket ship with 64GB of premium-grade Corsair Dominator Platinum DDR4 RAM clocked at 2,800MHz. This ensures we have enough high-velocity memory to engage ramming speed! The RAM also features Corsair's DHX cooling system, to help our system stay cool when it blasts out of orbit.

CORSAIR
DOMINATOR
PLATINUM
DDR4
2800

Cooling

EKWB DUAL-LOOP COOLING

ROCKET FUEL. The thing about rockets is that they get hot. Really hot. For a rocket as intergalactic as ours, we needed an ultra-dependable cooling solution, so we went with EKWB. It's a company that makes what we think are the best custom liquid-cooling solutions on the market, and it shows.

For Dream Machine, we decided to separate cooling into two discrete systems: one for the 5960X central processing unit and one for the four liquid-cooled Hydro Copper Titan Xs. Because our Titan X rockets will run the hottest, we equipped dual reservoirs to provide ample coolant circulation and paired the loop with a double-thick radiator in a push-pull configuration.

Both loops have their own radiators and pumps, but we didn't stop there. The entire cooling system is fueled by a separate power supply that ensures our rocket has enough energy, in case we ever get lost in space.

LC Solution Coolstream PE

SSDs

4X SAMSUNG 850 PRO 1TB

WARP DRIVES. While M.2 PCIe SSDs are faster than standard SATA drives, one issue that prevented us from going the NVMe route was our four graphics cards. With four cards, PCIe lanes come at a premium. Regardless, we were able to greatly mitigate this issue by going with four of Samsung's 1TB 850 Pro SSDs, some of the fastest SATA SSDs around.

We call these bad boys warp drives. We also combined them into a super fast RAID 0 set—think of it as having four main thrusters instead of just one. With over 2GB/s peak transfer rates and 4TB storage, there's plenty of room for the OS, applications, your entire Steam library, and a healthy chunk of videos and images that will keep us occupied as we drift our way through the solar system. We're beaming ourselves into a time when SSDs finally surpass HDDs in capacities as well as performance.

DDR4
DDR4
2800
DDR4
2800
RSAIR
SAMSUNG
Solid State Drive
SAMSUNG
Solid State Drive
SAMSUNG
Solid State Drive
SAMSUNG
Solid State Drive

HDDs

4X WD BLACK 6TB

6.0TB
6.0TB
6.0TB
6.0TB
WD
SATA / 128MB Cache
WD6001FZWX
WD Black
Desktop Hard Drive

CARGO BAYS. If the SSDs are the main thrusters of our rocket, the hard drives are the cargo bays. In terms of bang for your buck, HDDs still reign when it comes to price-per-GB. Where the 1TB Samsung SSDs cost over $600 each, Western Digital's 6TB Black drives only cost $300—half the price for six times the storage!

The drives are again using RAID 0, providing a massive 24TB of storage, which can be divvied up into multiple smaller partitions or a single 24TB GPT block. It's enough space for 1,200 hours of 48Mb/s Blu-ray content, or about 7,000 hours of good-quality 8Mb/s video.

Just think about it. Using H.265, we could easily set up a full year of non-repeat 4K video! This is enough storage to get you to infinity and beyond!

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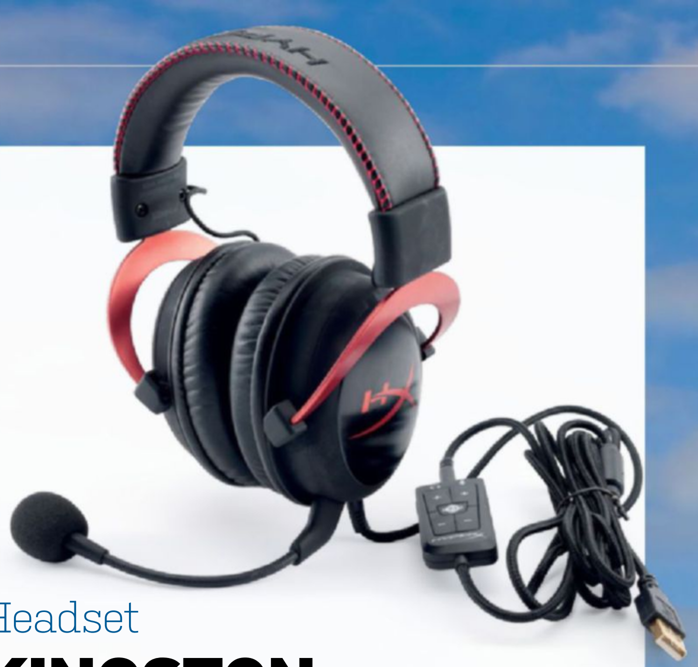
ASUS recommends Windows.
ROG **SWIFT PG278Q**
STRIX **GTX 980 TI**

Soundcard

CREATIVE SOUND BLASTER X7 LIMITED EDITION

SOUND CONTROL TO MAJOR TOM. On any mission, making sure you can hear what's going on, loudly and clearly, is essential. This triangular block with *Battlestar Galactica*-like corners fits the bill and offers lots of options.

This external soundcard features a maximum output of 100W (50W + 50W) and headphone amp impedance of 1 ohm. Despite the X7's impressive power output, we went with powered speakers. There's also a built-in mic, so you don't need a gaming headset to talk to Houston.



Headset

KINGSTON HYPERX CLOUD II

BEAMING YOUR EARS TO CLOUD NINE. We gave this headset a 9 Kick Ass back in June, so we didn't have to look far to play our best Nep-tunes. It has aluminum construction with a stitched vinyl-covered memory foam headband, and detachable mic.

It also comes with both vinyl- and fabric-covered ear cups, making them comfy enough to wear for hours. Virtual 7.1 mode kept us ducking in our dogfights, and had us spacewalking when we made a stereo connection to the mothership.

Speakers

ADAM AUDIO ARTIST SERIES 5.1 SPEAKER SYSTEM

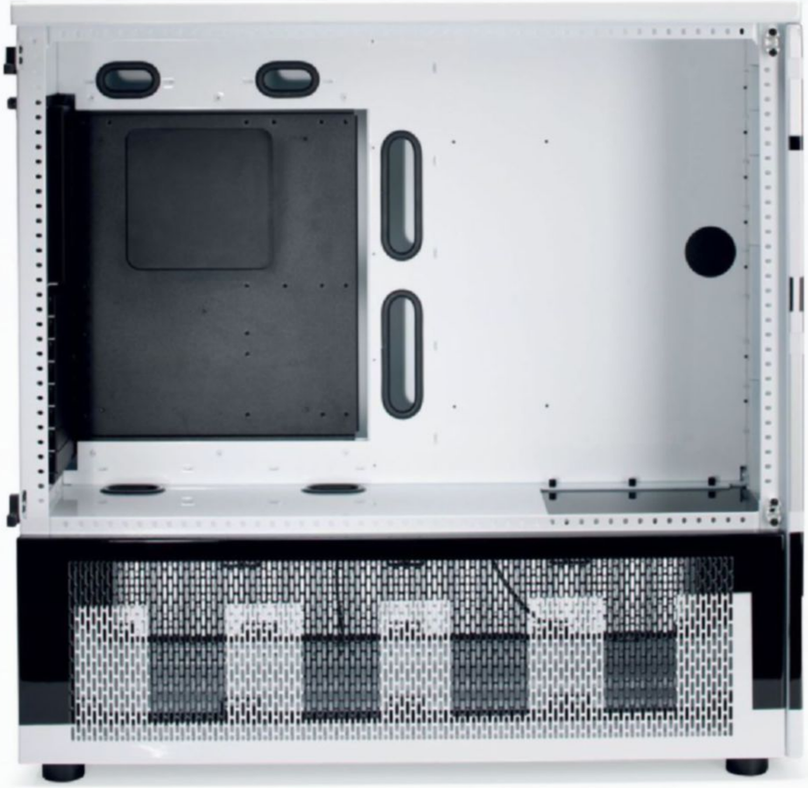
PARDON OUR NOISE; it's the sound of awesome. Nothing blows your hair back like the divine roar of rocket engines during a launch, or the soaring vocals of Diva Plavalaguna. We got four supersonic models from Adam Audio.

The big boys in the set—the ARTist 5s—have a range of 50Hz to 50KHz. The ARTist Sub fills in the bass, reaching from 150Hz down to 32Hz to let you feel the earth rumble as the main engines ignite. We used ARTist 3s as satellites and an ARTist 6H for the center, with ranges of 60Hz to 50KHz, and 55Hz to 50KHz, respectively.

The speakers all feature carbon fiber cones, Kevlar tweeters, more inputs than you can shake a space pen at, and individual crossover controls. If our rockets don't blow you away, these speakers will.

Case

MAGNUM SMA8



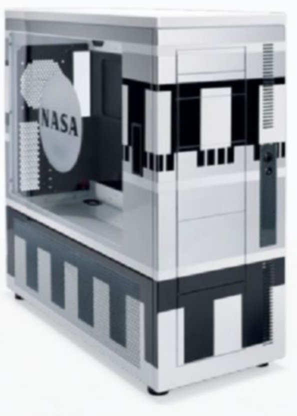
A HULL LOT OF LOVE. All the premium liquid-fueled rockets mean nothing to a spaceship if it doesn't have a premium-grade hull to protect it. A cheap chassis may suffer from hull degradation upon lift-off, or... you know, when you bang it against a table. That's why we went to the brilliant engineers at CaseLabs.

Interesting bit of trivia: CaseLabs founder Robert Keating was a chief weld engineer for NASA and helped develop rockets in the '60s. He played an integral part in the Apollo missions, including Apollo 11, which took us to the Moon. So, when it came time to choose a chassis for our DM15, we went with the obvious choice. It doesn't take a rocket scientist to know rocket scientists do good work.

While CaseLabs still does sheet metal fabrication for some jobs, it has evolved with the personal computing era and, as a result, is known today for its extremely modular and premium PC chassis. With the company's cosmically large Magnum SMA8 case, which measures 11.2x26x25.7 inches, we had enough room and flexibility to build the rocket of our dreams.

We could fit in four full-sized GPUs, custom liquid cooling, two massive radiators, and eight storage drives with ease. The all-aluminum construction also has sturdy blast shields, while the hull is light enough to ensure an easy lift-off. Finally, we can open up the pod bay doors without the help of HAL 9000, plus the side doors come off easily—great for routine maintenance.

Arguably, the real star of the show is the Smooth Creations paintjob. We've used the company before to decorate our Dream Machines, but the result this time is smoother than the Milky Way. Its black, white, and silver pattern perfectly epitomizes the look of the Titan II GLV, plus has a super-killer finish. The NASA etching is also out of this world.



PSU

EVGA SUPERNOVA 1600 T2

ROCKET POWER. Ensuring that our rocket has enough power to go supernova is EVGA's aptly named SuperNOVA power supply. It's a 1,600-watt modular PSU that's composed of 100 percent high-quality grade Japanese Nippon Chemi-Con solid-state capacitors, which ensure this rocket will have ample power and be able to withstand the harshest conditions. We needed all the energy we could muster, too, and pushed our system to over 1,500 watts. Talk about a real lifesaver!

In keeping with the Titan theme, the SuperNOVA PSU also carries an 80 PLUS Titanium power efficiency rating, which is the highest standard there is. Because Platinum-rated PSUs are for the Soviets.

Keyboard

RAZER BLACKWIDOW CHROMA

MISSION CONTROL GETS FABULOUS. When you're entering commands before, during, and after launch, you want to make sure they're quick and accurate, whether you're in a capsule in Cape Canaveral or sitting behind a console in Houston. For this, we turned to Razer and the BlackWidow Chroma keyboard.

Besides just having lots of shiny customizable lights to signal aliens with, this keyboard has a simple and uncluttered layout. There's no elaborate, specialized function keys, and only five macro keys sitting to the left of the main bank. The keys themselves feature Razer's green switches, with slightly less actuation distance (1.9mm) than the typical 2.2mm. That may not matter much, but when you need a fast response, that little extra could mean the difference between burning up or bouncing off the atmosphere like a rock skipping across a pond.

Mouse

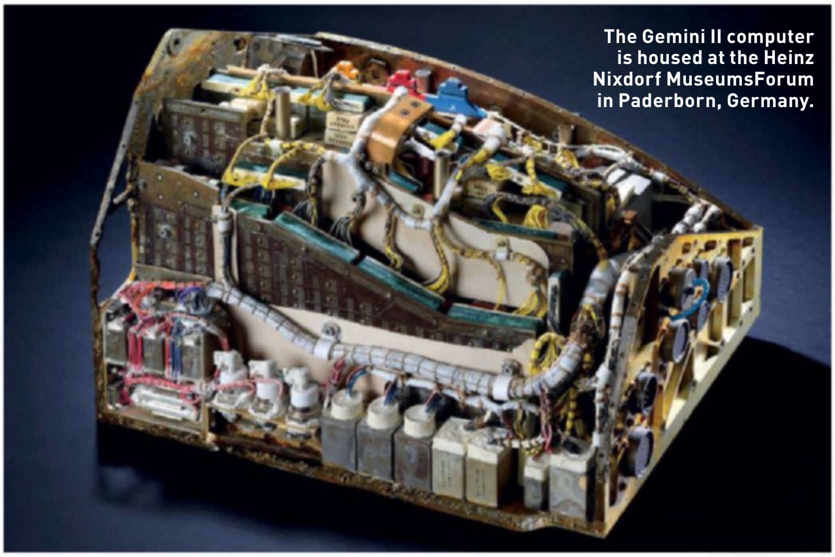
LOGITECH G303 DAEDALUS APEX

ORBITAL CONTROL IN THE PALM OF YOUR HAND. This spacey mouse is simple, as gaming mice go, and we think that's a good thing. You won't find crazy button layouts here. This lightweight, compact mouse has an uncomplicated, accessible layout, perfect for crewmembers who need precise response without complexity.

Visually, the G303 keeps it elegant, with RGB lighting that's projected through gratings on either side of the mouse, producing ovals on your desk. The mouse sports up to 12,000dpi for players who prefer twitchy movements of the hand and wrist.

Finally, the G303's design makes it usable (even if not ideal) for lefties. The two thumb buttons are accessible with the ring finger, and there's no molding to make the mouse awkward.

©WIKIMEDIA/CREATIVE COMMONS



The Gemini II computer is housed at the Heinz Nixdorf MuseumsForum in Paderborn, Germany.

©JAN BRAUN/HEINZ NIXDORF MUSEUMSFORUM.

PROPELLED BY TITANS

WHAT THE GEMINI PROGRAM MEANT FOR NASA AND SPACE COMPUTING. When people think of the American space program, most will picture manned spaceflight programs. More specifically, they think about the Apollo Moon missions or the Space Transportation System (space shuttle) program. But what happened before Apollo?

The Gemini program is where astronauts like Apollo 11's Neil Armstrong, Buzz Aldrin, and Michael Collins cut their teeth in the art of flying spaceships. Gemini saw the beginnings of advanced guidance computing in manned spaceflight.

We were interested in learning more about the program, so reached out to the Smithsonian Institution in Washington, D.C.. We contacted National Air and Space Museum public affairs specialist Alison Mitchell, who connected us with curators Paul Ceruzzi and Michael Neufield.

Neufield told us the Gemini Launch Vehicle was the Martin Aircraft Titan II, a converted US Air Force intercontinental ballistic missile from the 1950s.

"Gemini's purpose was to test critical operations and technology needed for Apollo," Neufield said. Gemini had three major objectives; first was to perfect the docking maneuvers that would later be necessary for mating a command module with a lunar excursion module (LEM), or Moon lander. Gemini was also used to see if humans could survive two weeks in space, and to help train astronauts for extra-vehicular activity (also known as an EVA, or spacewalk). The Gemini program also "demonstrated US space capability in the Cold War," Neufield said. In the end, it helped the United States catch up with and ultimately pass the Soviet Union in the Space Race.

Besides the social and vehicular impacts, Gemini also marked the first time Americans had used digital computers in space. "The Gemini computer was the first digital computer in an orbiting, manned spacecraft," said Ceruzzi. "It was built by IBM Federal Systems in Owego, New York, using discrete components. It did not use integrated circuits, although the transistors were made of silicon not germanium, which was an innovation."

King of cool

This was 1965, when computers would take up entire rooms. In comparison, the Gemini computer was compact and light. "It was in a box approx. 19x15x13 inches, and weighed 59 pounds," Ceruzzi told us. "One addition time took 140 milliseconds. It used ferrite core memory, containing 4,096, 39-bit words (equivalent to about 20K, though the comparison is not a good one as it had a complicated word structure). Gemini VIII and later missions also had a magnetic tape auxiliary memory, of about 150K."

The Gemini computer was used for guidance and docking, Ceruzzi said. Before Gemini, ground radar and radio stations would track and beam-up commands, but proved too slow and imprecise for docking. Instead, NASA put a computer onboard to do the arithmetic. The onboard computer was also capable of taking control of the Titan II launch vehicle if needed.

And by the way, the black-and-white paint schemes for the Gemini and Apollo rockets and vehicles had a real-world purpose: cooling. This means the Gemini project was cooler in more ways than one.

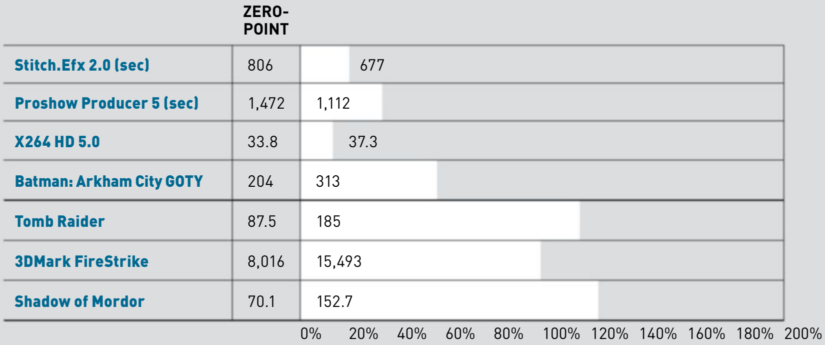
Conclusion

FASTER THAN LIGHT

ALL SYSTEMS GO. When it came time for Dream Machine 2015 to perform, our rocket was able to make the Kessel Run in less than 12 parsecs. With all eight of our CPU engines blasting at 4.5GHz, it outperformed our desktop zero-point by 11–32 percent, which is crazy considering our ZP also uses a 5960X. You can attribute these gains to our amazing custom-cooling system from EK, which not only performed out of this world, but also stayed stealthily quiet under load.

Perhaps the real neutron stars, however, were our four water-cooled Titan X GPUs. With our spacious case, robust cooling setup, and Titanium-rated 1,600-watt PSU, we were able to crank the power target

BENCHMARKS



	ZERO-POINT	
Stitch.Efx 2.0 (sec)	806	677
Proshow Producer 5 (sec)	1,472	1,112
X264 HD 5.0	33.8	37.3
Batman: Arkham City GOTY	204	313
Tomb Raider	87.5	185
3DMark FireStrike	8,016	15,493
Shadow of Mordor	70.1	152.7

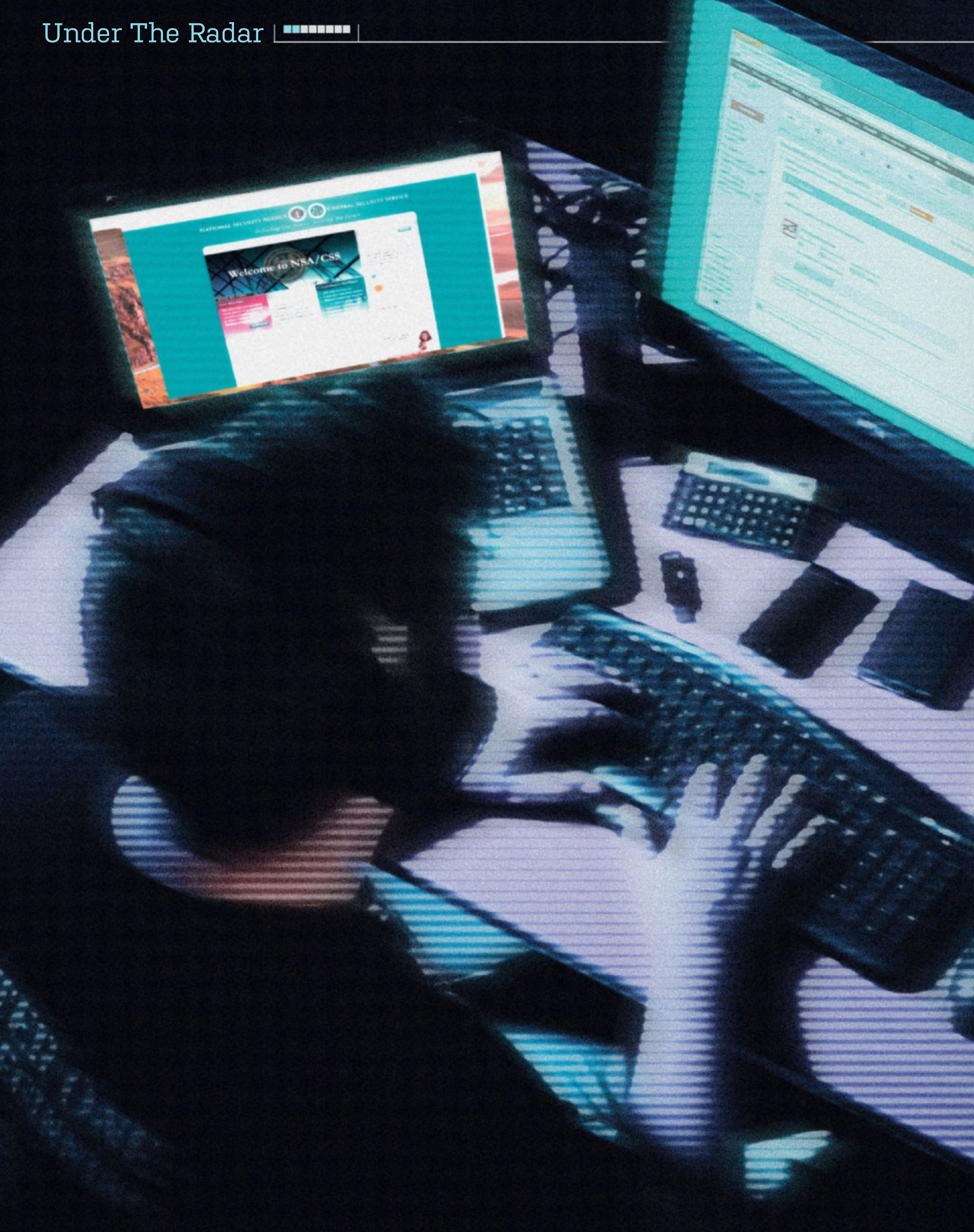
Our desktop zero-point PC uses a 5960X CPU, three GTX 980s, and 16GB of RAM. *Arkham City* tested at 2560x1440 max settings with PhysX off, *Tomb Raider* at Ultimate settings, and *Shadow of Mordor* at Max settings.

on these GPUs to 110 percent, boost the voltage by 112mV, overdrive each core clock by 205MHz, and dial up the memory clock by 734MHz. At the time of writing, if you don't count liquid nitrogen setups that traverse the galaxy through unsustainable black holes, Dream Machine 2015 is among the top five fastest PCs in both the 3DMark FireStrike Ultra and 3DMark 11 Extreme benchmarks. We're pretty sure we've inadvertently set off the beacon indicating to higher life forms that our technology has evolved enough to join their inner circle.

Seriously, this build blasted our zero-point by 53–117 percent in our graphics tests, which is beyond impressive as our ZP has three GTX 980 missiles of its own. Dream Machine could play *GTA V*, a super graphically demanding game, maxed-out on Dell's incredibly sharp 5K monitor, with average frame rates of 70–90fps. Sure, those figures are with antialiasing disabled, but at 5120x2880 resolution, you'd need to bust out a telescope to spot any jaggies.

Even our 850 Pro warp drives in RAID 0 were able to hit light speed, with sequential reads and writes measuring 1,654MB/s and 1,290MB/s, respectively. That's among the fastest read and write speeds we've ever seen in our Labs. Dream Machine 2015 is not only the fastest computer we've ever built, it's the fastest computer we've ever tested. Ladies and gentlemen, we have done it, we have won the Space Race!

DELL
CREATIVE


National Security Agency
Central Security Service
Welcome to NSA/CSS

GOING UNDER THE RADAR

We reveal who's watching you online and the best ways to shut them out

By Ben Andrews

PICTURE THE SCENE. You're minding your own business, happily downloading torrents, when the FBI storm your room and drag you to jail faster than you can say "fresh meat." This actually happened... in *South Park*. In reality, your pert posterior probably won't be in danger of hosting uninvited appendages quite so quickly, but the wrong kind of Internet activity can still land you in hot water.

Assuming you're not pirating, there's nothing inherently wrong with guarding your personal details and browsing habits. If photos of Miley Cyrus's underarm gardens float your boat, why should anyone be able to eavesdrop on your antics? In fact, it's far more likely that your privacy is compromised by advertising agencies than anyone else. From a simple Google search, to pretty much any ad-funded website, your browsing behavior can be tracked to establish which ads you're most likely to click on.

Fortunately, there are plenty of ways to prevent this monitoring. We'll show you some of the best options, from simple tricks to more hardcore solutions that can shield you from almost any surveillance. But before the juicy stuff, a shameless disclaimer. Any tips, guides, or methods in this feature are not guaranteed to protect your anonymity. If you use them to hide illegal activity, don't come crying to us if you're identified, extradited to Guantanamo, and have electrodes stuck where the sun don't shine.

Hit The Road to An

From blocking cookies to hiding your IP address, here's how

INTERNET PRIVACY tends to make headlines with stories of autocratic governments spying on their citizens, creating the impression that we're all careering straight into an Orwellian dystopia. But while state surveillance is undeniable, the first invasion of your privacy is far more likely to come via a humble Google search. Although apparently anonymous, Google has a habit of tracking your searches in order to bombard you with ever-more personalized advertising. By contrast, a search engine such as www.duckduckgo.com generates unbiased search results without the added user profiling or tracking.

Switching to a less profit-driven search engine will certainly help you on the road to anonymity, but visit a few websites and inevitably you'll receive cookies. These tiny text files are usually perfectly legitimate ways for websites to record things, such as frequently viewed items, so they'll appear on your next visit. But, just as dear Toothless, *How To Train Your Dragon*'s wouldn't-hurt-a-fly dragon, was turned to the dark side, so too can be the humble cookie.

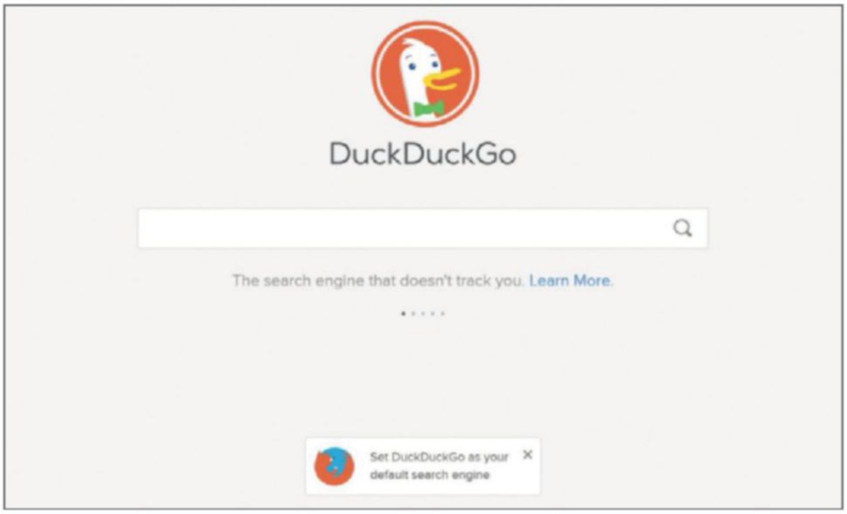
Tracking cookies are much more invasive and compile records of your browsing habits and personal details in order to target you with specific adverts. Since 2011, US law has increased cookie awareness by requiring websites to display those homepage banners that you can't miss, but it's really just a token nod.

A more promising attempt at keeping your browsing less trackable is the Do Not Track HTTP header, now integrated into all common web browsers. When activated, websites are requested not to use tracking cookies. However, the key word there is "requested," as while Do Not Track may be great in theory, the feature can't actually prevent websites and advertisers from tracking you. There's no law to say they can't completely ignore a DNT request.

CLEAR THE SLATE

So, it's entirely up to you to stay anonymous. Clearing your browser cache and cookies through your browser's settings is a start. You can also use clean-up software such as CCleaner (www.piriform.com/ccleaner) to delete cookies, temporary Internet files, and various other web leftovers from multiple browsers in one go.

Once you've got a clean slate, start utilizing private browsing modes for more than just keeping your foot fetish under wraps. Whether it be Microsoft's InPrivate feature, Firefox's Private Browsing mode, or Incognito in Chrome, all do a pretty good job of preventing nosey tracking cookies from setting up camp on your PC. But even without going into full-on porn mode, the big browsers also allow you to block third-party cookies. While this doesn't create an impenetrable wall, it's a lot more effective than the pathetic Do Not Track request.



DuckDuckGo

The search engine that doesn't track you. Learn More.

Set DuckDuckGo as your default search engine

Unlike Google, DuckDuckGo doesn't keep tabs on your web searches.

Another easy way to regain control of your Internet anonymity is by exploiting browser extensions to close privacy loopholes. Active web content such as Java, Flash, and Silverlight can be used to obtain system information without your knowledge and piece together various browsing habits. Automated scripts can also be potential security risks, so controlling exactly what web content can and can't run is a good thing. Browser extensions like NoScript for Firefox and ScriptSafe for Chrome allow you to do exactly that, blocking all active web content and asking for your approval before letting it run. At first, these extensions can be almost as annoying as User Account Control, but the more you use them, the smarter and less intrusive they get.

SPOT THE SPIES

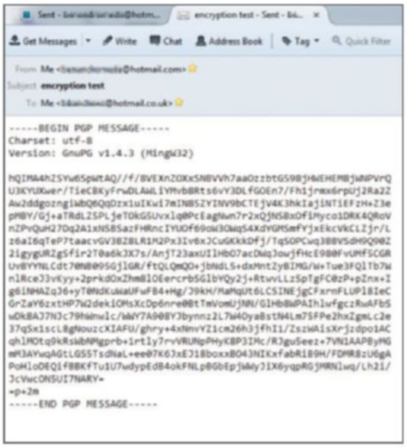
The problem is, even when web tracking is largely legitimate, the fact that it happens mostly without your knowledge inevitably provokes distrust. Wouldn't it be great if you could see exactly who's trying to sneak information about you and stop them in their tracks? Well, that's exactly what extensions such as Ghostery and Disconnect do. Both are available for IE, Firefox, and Chrome.

With a simple browser button, you can see a list of all the active advertising, analytics, and social media tracking organizations on a current webpage. You're even able to control which ones can collect information about your browsing session. Both extensions are dead easy to use and far less troublesome than script-blockers. Plus, unlike private browsing modes, which simply stop tracking organizations from leaving cookies, these extensions can actually prevent them from monitoring you. Far more effective.

However, just because your browser is locked down doesn't necessarily mean your system is secure. Any malware already present on your PC may still be snooping on you, and carelessly downloading the wrong zip, executable, or even PDF file can also transmit your personal details to unintended recipients.

In an ideal world, any suspect file should be opened on a computer that's permanently offline, but since that's easier said than done, you can get similar protection by installing a virtual machine.

onymity
to get off the grid



Subject **encryption test**

```
-----BEGIN PGP MESSAGE-----
Charset: utf-8
Version: GnuPG v1.4.3 (MingW32)

-----END PGP MESSAGE-----
```

Here's what an encrypted email looks like. Stare at it long enough and you'll see a silhouette of Jesus.

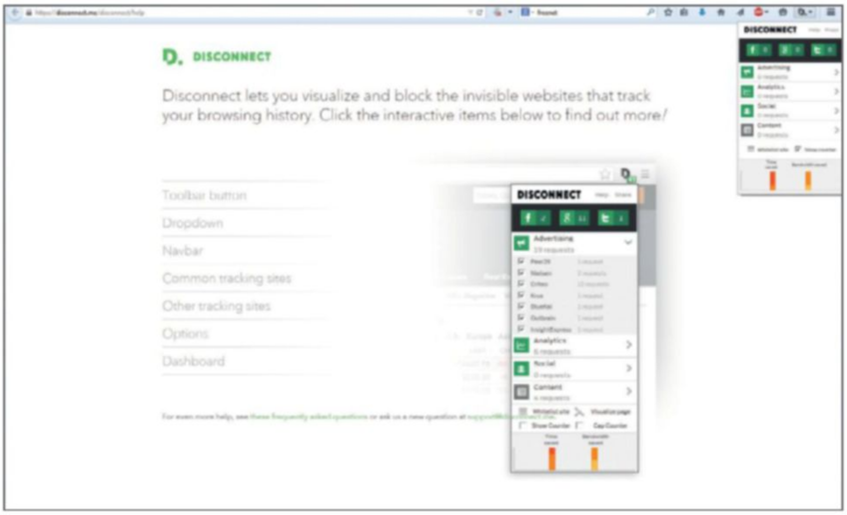
Two powerful yet free options are VMware Player (www.vmware.com) and VirtualBox (www.virtualbox.org). With one installed, all you then need to do is set up a free Linux distribution within it. Before opening a suspicious file, ensure the virtual machine has no Internet access and take a snapshot (similar to creating a System Restore point) to revert back to once you've dealt with the suspicious file.

Even better, why not do away with the virtual machine altogether and create a live Linux environment that's run entirely from a USB flash drive? Using a regular Linux ISO image, tools such as LinuxLive USB Creator (www.linuxliveusb.com) will produce a portable, bootable, and self-contained Linux OS that can be run from any host computer with no reboot required. As no files are modified on the host system, a live Linux environment can be used away from home, at an Internet café, for example.

ENCRYPTING EMAIL

Email attachments aren't the only way that your privacy can be compromised. Your actual written email correspondence is also far from anonymous. Way back when Google launched Gmail with its immense (for the time) 1GB storage limit, it was, unsurprisingly, less keen to market how this capacity was funded. Google did, and does, scan email content in order to target you with personalized ads, and Yahoo is up to the same tricks. So when you next see ads for both Miley Cyrus's latest album and Veet appear by your emails, you'll know why.

Thankfully, there's no shortage of ways to keep your emails tight. If you're serious about email anonymity, providers such as Hushmail (www.hushmail.com) offer built-in PGP email encryption and no advertising. Email another Hushmail user and your message is automatically encrypted when sent and decrypted when read. Email a non-Hushmail recipient and you can still use encryption, but require them to answer



Disconnect lets you visualize and block the invisible websites that track your browsing history. Click the interactive items below to find out more!

With a simple browser extension like Disconnect, you can see who's tracking you.

Paranoid or Prudent?

Edward Snowden, enemy of the state. Incredibly brave or incredibly stupid?

Several years ago, you'd have had a tough time finding a dartboard in the Pentagon without Julian Assange's face on it. But that all changed in 2013, when his position as arch-intelligence enemy was taken by a US National Security Agency contractor by the name of Edward Snowden. Snowden leaked up to 1.7 million classified documents, revealing the extent of mass surveillance around the globe.

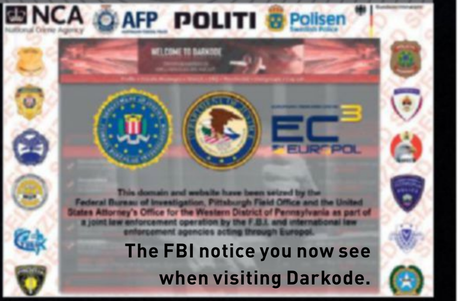
Key revelations included the existence of PRISM: a partnership between the NSA and numerous major Internet companies, including Google, Apple, Microsoft, Yahoo, and Facebook. PRISM enables the NSA to access the emails, documents, photos, and personal details of any non-US citizen, outside of the US, from its participating companies, without having to specify an individual target or communications method.

That, however, doesn't mean US citizens can rest easy. Indeed, a leaked NSA inspector general's report stated the "NSA maintains relationships with over 100 US companies" and that the US has the "home-field advantage as the primary hub for worldwide communications." One leaked court order, for example, revealed Verizon has been told to hand the NSA details of all calls in its systems, in bulk, on an "ongoing, daily basis."

Snowden's leaks also revealed that the UK's Government Communications Headquarters (GCHQ) taps around 200 fiber-optic cables carrying global Internet and telephone data, amounting to up to 600 million daily communications. Data, stored for up to 30 days, is shared with the NSA.

Snowden's leaks also detailed how the NSA had collected over 200 million global text messages per day. The really scary bit? This surveillance was able to gain information on individuals who were not under any criminal suspicion.

Hacking the Hackers



This domain and website have been seized by the Federal Bureau of Investigation, Pittsburgh Field Office and the United States Attorney's Office for the Western District of Pennsylvania as part of a joint law enforcement operation by the F.B.I. and international law enforcement agencies acting through Europol.

The FBI notice you now see when visiting Darkode.

Of all the people on the Internet, you'd think hackers would be more paranoid than most when it comes to privacy. But that didn't help those using infamous hacking forum Darkode, which was recently taken down by the authorities in 20 countries, as part of the FBI-led Operation Shrouded Horizon. A site frequented by cybercriminals, Darkode was essentially a marketplace for botnet services (think DDoS attacks), stolen credit card and banking details, zero-day exploits, and various other nasties.

The takedown is notable for the fact that Darkode was one of the major English-language hacking forums in the world (there are believed to be over 800 hacking sites worldwide, but the vast majority are not in English). It was also significant for being visited by members of Lizard Squad, a group of hackers who claim responsibility for carrying out high-profile attacks on the likes of Sony and Microsoft.

The clampdown is an obvious boon for the security services, but it also highlights the importance of privacy, particularly as Darkode members were known to boast about how the site was impenetrable and used so-called "bulletproof" hosting providers. Potential users could also only gain access to the site if their name was put forward by an existing member. It sounds good in theory, but as ever with any kind of security, the weak spot was the human element. The site was ultimately taken down due to the fact that the FBI managed to infiltrate the Darkode membership itself.

As part of the operation, 28 people were immediately arrested for cybercrime offences. That quickly climbed to 70 people around the world, a number expected to rise higher and higher, now that the Feds have full access to the site and the transactions that have taken place.

> "If you're connected to the Internet, you're flying above the radar, unless you're concealing your IP address."

a secret question before the message can be read. Clever stuff, but you'll need to part with $35/year for it, or there's a free version if you can stick to a 25MB storage limit.

Alternatively, you can also encrypt mail sent via webmail accounts like Gmail, Outlook, and Yahoo, by using a desktop email client such as Mozilla Thunderbird, plus a few other tools. With Thunderbird installed and configured as your email client, download and install the free GNU Privacy Guard encryption software (www.gnupg.org), and then the Enigmail Thunderbird extension (www.enigmail.net), and follow the configuration wizard. If that all sounds like overkill for sending a couple of anonymous messages, then consider a disposable email address instead. Guerilla Mail (www.guerrillamail.com) and Mailinator (https://mailinator.com) both fit the bill, letting you quickly send and receive anonymous mail with no incriminating sign-up processes or content scanning.

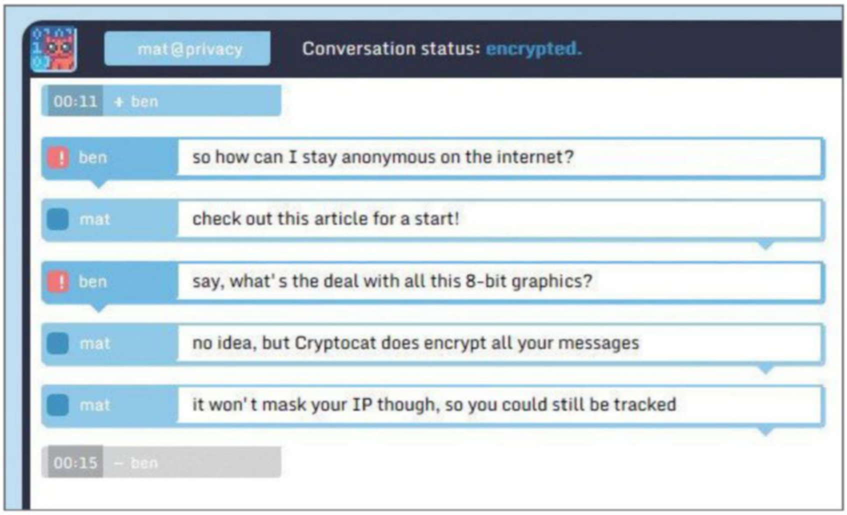
The wonders of encryption can also keep instant messaging secure. Apps such as Cryptocat (https://crypto.cat) will integrate with Chrome, Firefox, or Opera, giving you an encrypted chatroom to converse with other Cryptocat users. To minimize traceability, there are no static user accounts, so you create a dynamic username each time you connect. Once in, you can start your own conversation or type the title of one that's already active to join in. No group conversations are private though, so anyone who requests your conversation name is free to participate. However, you can select an individual participant for a private chat, as well as sending encrypted files and photos.

THE BIG BAD WORLD

Exposing and blocking advertisers or encrypting email can certainly help you take back some control of your privacy, but it's not enough to keep you and your location hidden. Whenever your computer is connected directly to the Internet, you're still flying well above the radar unless you've taken some measures to conceal your IP address.

There are numerous ways to hide your IP address, but do you need to? The gatekeeper of your identifiable details is your Internet service provider. But, in the United States at least, they're unlikely to phone the 5-0 if you've torrented your favorite Justin Bieber song, though they probably should on the grounds of crimes against taste.

The US Copyright Alert System is more lenient than you might imagine. If you're found illegally downloading a copyrighted file by the rights holder, they can record and submit your IP address to ISPs participating in the alert program. If one ISP happens to be your provider, then you'll be sent a copyright infringement notification letter informing you of ways to avoid future



Conversation status: encrypted.

00:11 + ben

ben: so how can I stay anonymous on the internet?

mat: check out this article for a start!

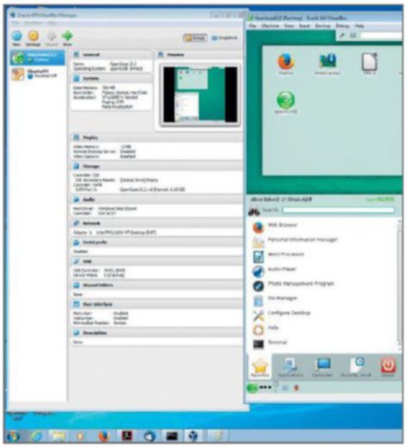
ben: say, what's the deal with all this 8-bit graphics?

mat: no idea, but Cryptocat does encrypt all your messages

mat: it won't mask your IP though, so you could still be tracked

00:15 – ben

It looks worse than the original MSN Messenger, but Cryptocat is great for anonymous IM.



While not foolproof, virtualization can offer another level of protection when trying to stay under the radar.

breaches. You get up to six warnings. By the fifth or sixth warning, ISPs may start throttling bandwidth or using various other measures to make naughty subscribers play ball. Even then, however, ISPs aren't automatically required to disconnect subscribers or disclose personal details to the copyright holders.

This all sounds refreshingly forgiving, but relying on your ISP to protect your identity isn't advisable. Even when most providers are reluctant to divulge your details (snitching on you to the cops isn't a great way to ensure customer loyalty), sooner or later they'll bend over and give in to the long greasy arm of the law.

Just take the ongoing case of Voltage Pictures. The production company behind *The Hurt Locker* and *Dallas Buyers Club* has developed a reputation for being a copyright troll, by sending threatening letters, demanding financial compensation, to alleged pirates. Voltage claims to identify the pirates by collecting IP addresses from BitTorrent swarms, though serious questions remain over the reliability of the evidence. After resistance from ISPs, the firm has gained court orders in several countries, including the United States, that force ISPs to hand over details of the customers linked to those IP addresses.

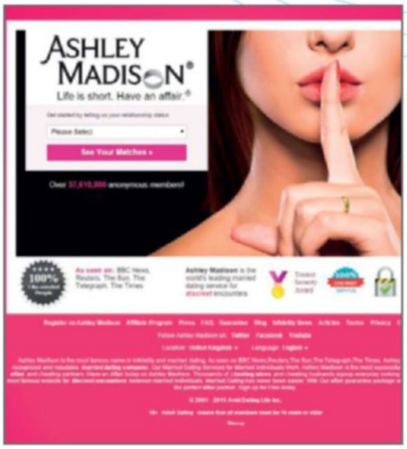
Those customers then receive letters that threaten legal action if a financial settlement is not agreed upon. No matter how dubious the evidence, however, defending your corner will be expensive. In one series of cases in Chicago, defense costs were estimated at up to $50,000, making it unsurprising that many chose to settle with Voltage for around $5,000.

Now, to make it clear, we absolutely don't condone copyright infringement. The degree of financial damage that piracy has on the entertainment industry may be questionable, as might be attempts to fine illegal file-sharers a zillion times the cost of an equivalent legit download. But unless it would be ethically and financially viable for everyone to cheat the system, then exceptions can't be made for a few. However, not all torrents infringe copyright, so here are a couple of ways to keep legal torrenting anonymous.

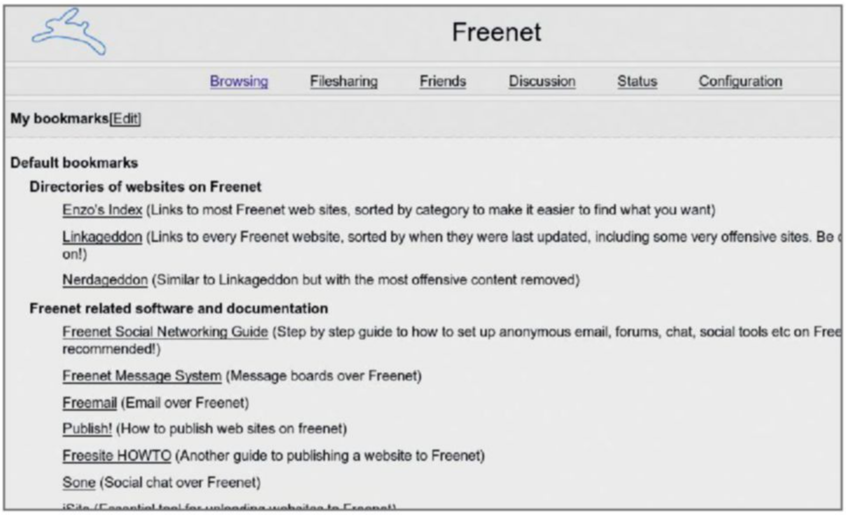
TORRENTING

Firstly, use a seedbox. This is effectively a remote server that you can log into via a webpage and use to download and upload torrents on your behalf. Completed torrents can then be transferred from the seedbox to your computer via FTP, therefore preventing any torrent traffic being directly associated with your home IP address. Some seedboxes won't allow connections to public torrent trackers though, therefore restricting you to private trackers and possible ratio requirements. It's likely you'll have to part with at least $5/month to use one, but then freedom isn't free. It costs folks like you and me.

Another option is to try a proxy server, such as BTGuard (https://btguard.com). These have the effect of hiding your IP address from other members of a torrent swarm by funneling torrent traffic via a proxy (intermediary) server computer. If prying eyes are monitoring IP addresses connected to a certain torrent, they'll see your proxy's IP, not your own. And from the other end, your ISP will only see you connecting to a proxy service, rather than



The recent hack of Ashley Madison highlights that our privacy is often left in the hands of others. For better or worse.



Freenet

Browsing Filesharing Friends Discussion Status Configuration

My bookmarks[Edit]

Default bookmarks

Directories of websites on Freenet

Enzo's Index (Links to most Freenet web sites, sorted by category to make it easier to find what you want)

Linkageddon (Links to every Freenet website, sorted by when they were last updated, including some very offensive sites. Be on!)

Nerdageddon (Similar to Linkageddon but with the most offensive content removed)

Freenet related software and documentation

Freenet Social Networking Guide (Step by step guide to how to set up anonymous email, forums, chat, social tools etc on Free recommended!)

Freenet Message System (Message boards over Freenet)

Freemail (Email over Freenet)

Publish! (How to publish web sites on freenet)

Freesite HOWTO (Another guide to publishing a website to Freenet)

Sone (Social chat over Freenet)

jSite (Essential tool for uploading websites to Freenet)

Freenet is a private peer-to-peer network that's completely under the radar.

“Tor has the same effect as a proxy server, fooling monitoring systems by faking your computer’s location. However, Tor can also be eye-wateringly annoying.”

WikiLeaks Submission Upload

Tor hidden services don’t use memorable URLs. Here’s Wikileaks’s catchy address: http://wlupld3ptjvsgwqw.onion

a torrent tracker. It’s not an impenetrable system though, as the proxy server itself may be a weak link. Should the provider keep records of its users and traffic, the paper trail could lead back to you. It’s therefore vital to do your homework before picking a proxy, especially as you’ll be shelling out a monthly fee that’s similar to a seedbox subscription. Free proxy servers are also around, but it’s likely their bandwidth will be low and downtime high. And don’t expect them to put up much of a fight if asked for your details.

Tor
Home
About Tor
Documentation
Press
Blog
Contact
Download
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Donate
Anonymity Online
Download Tor
Recent Blog Posts
Who Uses Tor?
Our Projects

Protect your privacy. Defend yourself against network surveillance and traffic analysis.

- Tor prevents people from learning your location or browsing habits.
- Tor is for web browsers, instant messaging clients, and more.
- Tor is free and open source for Windows, Mac, Linux/Unix, and Android

What is Tor?

Tor is free software and an open network that helps you defend against traffic analysis, a form of network surveillance that threatens personal freedom and privacy, confidential business activities and relationships, and state security.

Learn more about Tor »

Why Anonymity Matters

Tor protects you by bouncing your communications around a distributed network of relays run by volunteers all around the world: it prevents somebody watching your Internet connection from learning what sites you visit, and it prevents the sites you visit from learning your physical location.

Get involved with Tor »

Tor Browser

Tor Browser contains everything you need to safely browse the

Orbot

Tor for Google Android devices.

Tor Weekly News — July 15th, 2015
Wed, 15 Jul 2015 Posted by: harmony

Tor 0.2.6.10 is released
Sun, 12 Jul 2015 Posted by: nickm

Tor Weekly News — July 10th, 2015
Fri, 10 Jul 2015 Posted by: harmony

Preliminary analysis of Hacking...
Tue, 07 Jul 2015 Posted by: arma

Tor Seeks New Executive Director
Tue, 07 Jul 2015 Posted by: woeltzer

View all blog posts »

Family & Friends

People like you and your family use Tor to protect themselves, their children, and their dignity while using the Internet.

Businesses

Businesses use Tor to research competition, keep business strategies confidential, and facilitate internal accountability.

Activists

Browsing the web with Tor can be a frustratingly slow experience.

Proxy servers by nature aren’t just useful for anonymizing torrent traffic though. Your web browser can also be easily configured to connect to webpages via a proxy server, thereby hiding your IP address and also circumventing website blocks implemented by your ISP. It can even be possible to view country-specific video streaming services from abroad, though smart JavaScript or Flash implementation may help content providers sniff out your true IP and deny you access. This also highlights a general concern with proxy servers, as while they insert a hurdle to make tracking more difficult, they don’t conceal the entirety of your Internet traffic from source to screen.

TOR OF DUTY

One way to get closer to this level of security on the cheap is to use Tor, aka The Onion Router. If there’s an element of the Internet that divides opinion—even more than the contents of Sickipedia—it’s Tor. On the one hand, if you live in downtown Shanghai and want to access pretty much any western website, it’s a godsend. But if you’re a disciple of Chairman Mao, or even a western politician with a fear of what the proletariat might get up to, out of sight of your security agencies, then Tor is about as welcome as Bill Cosby is, well, anywhere.

In essence, Tor has the same effect as a proxy server, fooling monitoring systems by faking your computer’s location. But it considerably boosts your anonymity by passing your Internet data packets through multiple encryption servers (nodes) before they emerge on the open Internet (clearnet) and scoot off to your requested website.

As your IP address is concealed by so many encryption servers, you get multiple layers of protection rather than just a single proxy server barrier, and the result is analogous to the layers of an onion. However, Tor can also be eye-wateringly annoying. The numerous encryption servers that relay your data within the Tor network inevitably create speed bottlenecks, and, being volunteer-run, demand usually outstrips available bandwidth. You can’t just access the Tor network via any old web browser, either, as Tor requires its own modified, standalone browser, though this is a derivative of Firefox.

What’s more, while Tor does make it very difficult for agencies to perform traffic analysis, it’s not completely safe. The final Tor node that a packet is relayed through before exiting onto the clearnet is known as the exit node. There are more than 1,000 of these active at any one time, and though unlikely, it is still possible to eavesdrop on an exit node, as the data emerging there is unencrypted.

FREENET

An alternative anonymous network without this weakness is Freenet. This is different to Tor in that it’s not a means of accessing the clearnet anonymously, but rather a secure network in which to communicate and share files within trusted circles of contacts. Freenet uses a peer-to-peer model and allocates a portion of your hard drive to store Freenet data and serve it to the network. This is encrypted, as is all the data passed around Freenet, and thanks to such comprehensive end-to-end encryption, Freenet is almost impossible to penetrate and is ideal for anonymous communication and file sharing.

Users are also able to create and host Freesites, which are static websites hosted within, and only accessible from, the Freenet. There are also plugins for anonymous email, social network-style communication, and forum contact. However, as with other peer-to-peer file-sharing systems, transfer speeds are seed-

OpenVPN
Your private path to access network resources and services securely
VPN Service
VPN Solution
Community
Private Tunnel
iOS

Open standards can potentially provide the best solutions for your privacy—highlighted here with OpenVPN.

dependent—don't expect the overall speed of the network to be lightning-fast.

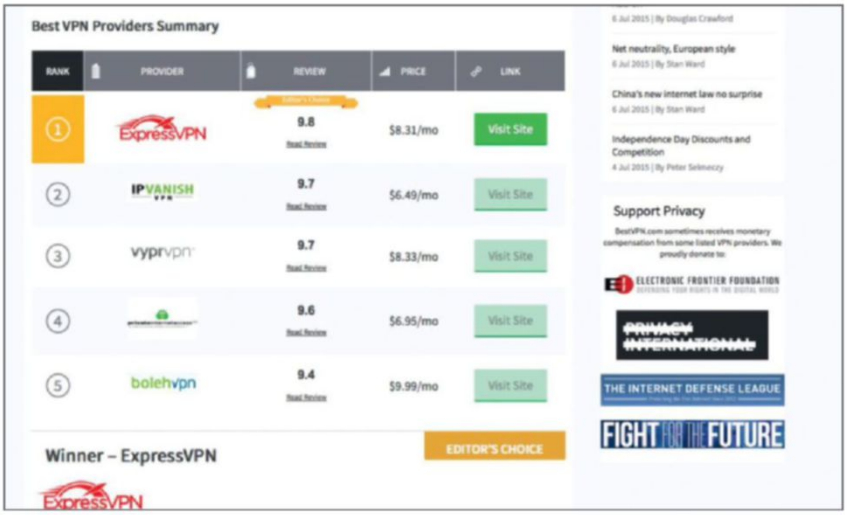
GOING VIRTUAL

Though networks like Tor and Freenet are useful for protecting privacy, their slow and limited functionality hardly makes them ideal. To go totally incognito with the fewest possible restrictions, you need a Virtual Private Network (VPN).

Where services like BTGuard will hide torrent traffic, and Tor can keep web browsing anonymous, A VPN will hide the entirety of your Internet traffic inside an encrypted tunnel. Traditionally, VPNs have been used by companies with employees working off-site, but now they're increasingly popular for the average Joe wanting to preserve their privacy. To exploit a VPN, firstly you'll have to hand over at least $5/month to subscribe to one of the huge number of personal VPN providers out there, and you'll also need to install that provider's client software so you can access your VPN tunnel. Inside the tunnel, data is encrypted to various degrees, depending on the quality of VPN you choose.

Similar to the potential Tor exit node vulnerability, the weakest links of a VPN tunnel are its entry and exit points. The VPN server is able to see all data that goes into and out of the tunnel, so if you want to sleep at night, leave no stone unturned in ensuring your VPN provider doesn't log any user details or monitor traffic. It's also a wise move to select a company that accepts payments by Bitcoin, to avoid any potential privacy breach that could occur if paying by credit card or PayPal. For more information on VPN providers, as well as comprehensive reviews, check out www.bestvpn.com.

With this amount of privacy protection in place, you'll now be well and truly under the radar. Still paranoid? It could be time to hone those Bear Grylls skills and get completely off the grid. ⏻



Best VPN Providers Summary

RANK	PROVIDER	REVIEW	PRICE	LINK
1	ExpressVPN	9.8 Read Review	$8.31/mo	Visit Site
2	IPVANISH VPN	9.7 Read Review	$6.49/mo	Visit Site
3	vyprvpn	9.7 Read Review	$8.33/mo	Visit Site
4	[illegible]	9.6 Read Review	$6.95/mo	Visit Site
5	bolehvpn	9.4 Read Review	$9.99/mo	Visit Site

Winner – ExpressVPN

EDITOR'S CHOICE

6 Jul 2015 | By Douglas Crawford

Net neutrality, European style
6 Jul 2015 | By Stan Ward

China's new internet law no surprise
6 Jul 2015 | By Stan Ward

Independence Day Discounts and Competition
4 Jul 2015 | By Peter Selmeczy

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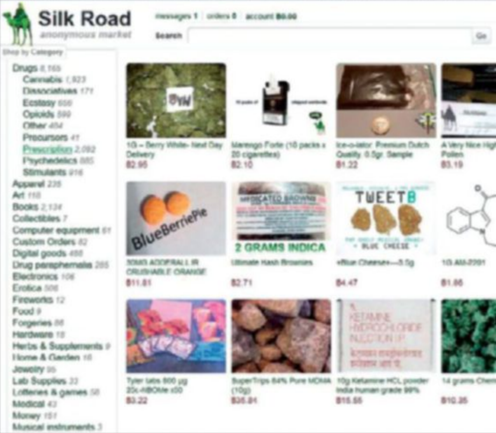
Before signing up to a Virtual Private Network, read the reviews at www.bestvpn.com.

The Darknet



Ahh, the darknet. It's a shame this gets such bad press, as its name sounds cooler than Clooney dipped in LN2. The darknet is part of, though not the same as, the deep web. This broader term encompasses any part of the Internet that cannot be indexed by search engines, such as webpages beyond a personal login. The darknet's difference is that it's anonymous and inaccessible via a standard browser.

Tor has become the most notorious darknet network, partly for its ability to circumvent governmental censorship, but mostly because of its hidden services. These are usually websites set up to only be accessible from connections routed through Tor encryption nodes from the Tor browser.

Unsurprisingly, hidden services tend to be organizations with a vested interest in anonymity, so you'll find The Pirate Bay has a hidden service on Tor, and the area of Wikileaks for uploading sensitive documents is also concealed here. More surprising is that Facebook also has a Tor service, though it's more for allowing oppressed Syrians to communicate with the outside world than to stop your bunny-boiler ex from tracking you down.

But the hidden service that really put Tor on the map is the now-defunct Silk Road. With its layered encryption, Tor is the perfect place for accessing the less wholesome things in life, and Silk Road was a global marketplace specializing in the drug trade. It may as well have been run by Walter White, but its actual creator, one Ross William Ulbricht, was caught and Silk Road got shut down. However, this wasn't down to weaknesses in the Tor network, but rather Ulbricht's sloppy promotion of Silk Road in open Internet forums being matched to an email address of rossulbricht@gmail.com. #Facepalm.

THE BEST E3 YET?

The most exciting game reveals from the 2015 expo

BY PHIL IWANIUK

The dust has settled and the crowds have dispersed. A thick crust of unwanted promotional USB sticks and energy drinks is all that remains at the Los Angeles Convention Center. It's time to take stock and reflect on an Electronic Entertainment Expo bristling with big-hitters, returning giants, and visibly sweating industry execs promising the world. The magnitude of E3 2015's lineup can't be denied, even if many of the names from the show —*Mirror's Edge*, *Doom*, *Final Fantasy VII*—are familiar. But did this year's roster of titles outshine all previous E3s? Let's take a look at the cream of 2015's crop.

Tacoma **Release date: 2016**

Here's what *Gone Home* creator Fullbright did next: a space station exploration game that shares the Pacific Northwest vibe of its previous project in name only. The eponymous Tacoma is actually a space station, which you'll find creepily abandoned. Except for a bunch of eerie-ass holograms, that is.

» **Publisher**: Fullbright
» **Developer**: Fullbright

XCOM 2 **Release date: November 2015**

Firaxis did such a good job of modernizing the turn-based strategy classic *XCOM* in 2012, it's not about to throw the baby out with the bathwater for the sequel. The broad strokes remain untampered, albeit with touted Steam Workshop integration to encourage user-created campaigns, classes, and enemies. Ooh, and it's a PC exclusive! For now.

» **Publisher**: 2K Games » **Developer**: Firaxis

Battlecry **Release date: Q4 2015**

Free-to-play, class-based PvP action with a heavy focus on gruesome melee combat (something of a running motif at this year's conference). *Half-Life 2* and *Dishonored* art director Viktor Antonov designed the world, which owes more to the latter, so you can be assured of its aesthetic prowess.

» **Publisher:** Bethesda » **Developer:** Battlecry Studios

Rainbow Six Siege **Release date: 13 October**

A return to close-quarters shooting for *Rainbow Six*, with *Siege*'s AnvilNext engine powering a show-stopping destruction model. Announced at Ubi's conference is Terrohunt, a one-to-five-player co-op experience, in which you complete objectives while AI-controlled terrorists give you a hard time.

» **Publisher:** Ubisoft » **Developer:** Ubisoft Montreal

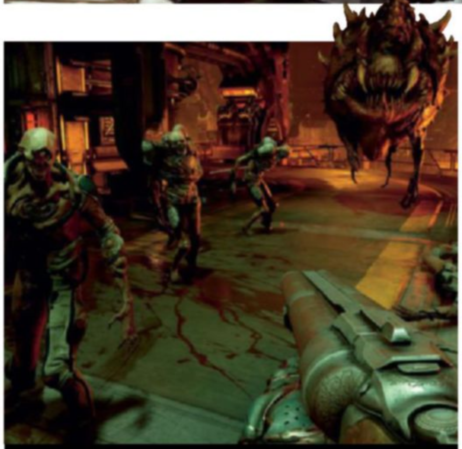
Assassin's Creed Syndicate

Release date: Q4 2015

Assassin's Creed heads to London at its grimiest—the Victorian era. New this year are a duo of playable characters, male and female (not too much work to animate women this year then, eh?), and a grappling hook that Ubisoft hopes will freshen up the parkour action a bit. Maybe it'll even be bug-free!

» **Publisher:** Ubisoft

» **Developer:** Ubisoft Quebec



Doom **Release date: Q4 2015**

id demoed a sizable chunk of its idTech6-powered shooter at the Bethesda conference, showing off not one but *two* shotguns among a host of familiar weapons and enemy types, including a chainsaw capable of turning Imps and Cyberdemons into little more than angry gore balloons. Close your eyes, gran!

» **Publisher:** Bethesda

» **Developer:** id Software

Ghost Recon: Wildlands **Release date: TBD**

Ubisoft loves describing its games as "emergent," and with this huge open-world tactical shooter, it might have imbued that buzzword with some meaning. You and three co-op buddies are given free rein to clean up a vast swath of Bolivia.

» **Publisher:** Ubisoft

» **Developer:** Ubisoft Paris

Dishonored 2

Release date: 2016

Emily Kaldwin joins Corvo as a playable character in the sequel to Arcane's impeccable 2011 stealth actioner, set some years after the original's events. Enough time for Em to grow up and get all stabby, anyway. Don't judge her, she had a tough childhood.

» **Publisher:** Bethesda

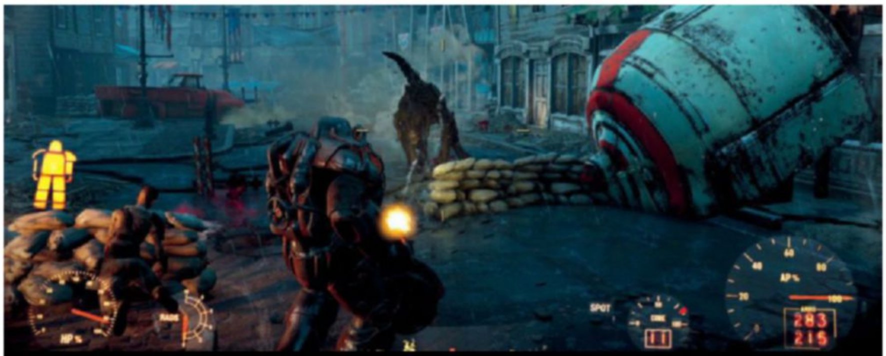
» **Developer:** Arkane Studios

Dark Souls 3

Release date: Q1 2016

Revered creator Hidetaka Miyazaki returns to *Dark Souls 3* as game director after ducking out of its prequel to focus on PS4-exclusive *Bloodborne*, so you can consider this the first thoroughbred *'Souls* since 2012.

» **Publisher**: Bandai Namco
» **Developer**: From Software



Fallout 4

Release date: 10 November

That's how you announce a game, everyone. Blow gamers' minds with an enormous and detailed (if slightly singed) open world, introduce an entirely new base-building and crafting mechanic, get everyone to fall in love with the dog, and then tell them it's out in mere months. Vault 111, here we come.

» **Publisher**: Bethesda » **Developer**: Bethesda Game Studios

Rise of the Tomb Raider

Release date: TBD

Lara's next adventure is a timed-exclusive for Xbox One, so a PC release hasn't been confirmed yet, but we're betting on her eventual arrival some time in 2016, after the console version's Christmas release. Here's hoping, because we want to fight bears in blizzards as much as anyone. Rumor has it there are even tombs to raid.

» **Publisher**: Square Enix » **Developer**: Crystal Dynamics

Mass Effect Andromeda

Release date: Q4 2016

Shepard's trilogy is done and dusted, but *Mass Effect* returns late next year with a new cast and setting—and a couple of familiar touches. Faster-than-light travel's still possible, even without the mass relays, and Bioware indicates there'll be a big focus on exploration. Which explains a revamped Mako buggy, ready to drive you around unfamiliar climes.

» **Publisher**: EA » **Developer**: Bioware

Mirror's Edge: Catalyst

Release date: 23 February

Continuing EA's "reboots for no clear reason" motif, Faith gets a second chance to overthrow a totalitarian regime by clambering all over stuff, this time in an impressively sprawling open world bereft of loading times and powered by DICE's dependable Frostbite tech. The whole city's your playground now.

» **Publisher**: EA » **Developer**: DICE

Need for Speed

Release date: 3 November

EA's "rebooting" its prizefighter arcade racer, which is marketing speak for "skipping a year so we can make a decent game." As such, there's a renewed focus on car customization and hokey underground street racing narrative. It all looks tremendously fun, actually. The Frostbite-caliber visuals don't hurt, either.

» **Publisher**: EA » **Developer**: Ghost Games

No Man's Sky

Release date: TBD

Previously slated for a PS4-only release, the *No Man's Sky* PC announcement was one of *the* good news stories to come out of this year's E3. Sure, we're not exactly starving for immersive, thousand-hour open-universe space sims at the moment, but the artistry and mystery of Hello Games's story-shrugging exploration experience sets it apart from anything else. What lies at the center of its universe? Tell us you're not curious. Go on, not even a little bit?

» **Publisher:** Hello Games

» **Developer:** Hello Games

Hitman

Release date: 8 December

Agent 47's return to the self-contained sandbox level design of *Blood Money* and *Contracts* is the best possible news for the series. Better even than the promised 300-plus inhabitants of each environment and a revamped multiplayer mode. It was worthy of a whoop on the showfloor. You're not going *anywhere* until you do one too.

» **Publisher:** Square Enix

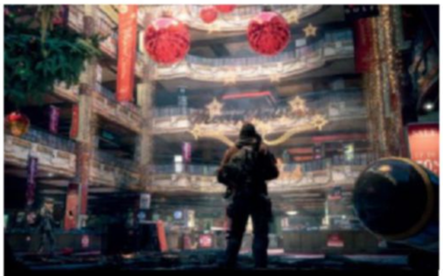
» **Developer:** IO Interactive

Star Wars Battlefront

Release date: 17 November

Oh, you thought we were done with the reboots? Hold that thought. Large-scale cinematic battles mean we finally get to feel like we're in a universe far, far away. Throw in the fact that the seventh film may not be a complete nightmare, and you have all the ingredients for a great game. Those at the show left with almost universal praise for DICE's vision.

» **Publisher:** EA » **Developer:** DICE



The Division

Release date: 8 March

Perhaps a victim of its own ambition (and Ubisoft's misguided decision to reveal it years before release), near-future MMO/shooter *The Division* may not carry the gravitas it did a couple of years ago, but its persistent world and cave-deep co-op still excite. Bonus news: the tablet companion app's been canned. Hooray!

» **Publisher:** Ubisoft

» **Developer:** Ubisoft Massive

South Park: The Fractured But Whole

Release date: TBD

Google its name and you'll almost certainly be put on a register somewhere (perverts with poor typing skills are high on the NSA's vigilance list, we've heard). So, suffice with this knowledge: *Stick Of Truth* developer Obsidian's ducking out of development duties for an internal Ubi studio, but fear not, TV show creators Parker and Stone are still around to craft another playable, feature-length episode.

» **Publisher:** Ubisoft

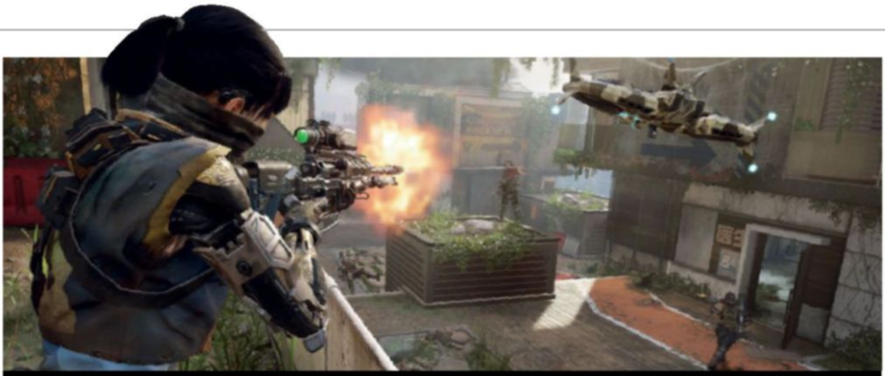
» **Developer:** Ubisoft San Francisco

Shenmue 3

Release date: December 2017

Long ago, Yu Suzuki released a couple of Dreamcast games about working as a forklift driver. A quasi-Kickstarted threequel became just about *the* story of E3.

» **Publisher**: TBC » **Developer**: Ys Net



Call of Duty: Black Ops 3

Release date: 6 November

Boo if you want to—*COD*'s enduring success has made it the villain of annualized releases. However, if *Black Ops III* isn't looking like a *Half-Life 2*-beater, it at least exhibits some interesting ideas in the form of hordes of android-like enemies with no self-preservation instinct and, er... improved traversal controls? No? Tough crowd.

» **Publisher**: Activision » **Developer**: Treyarch

SEE OCULUS RIFT GAMES WE PLAYED AT E3 2015 PG. 18

Firewatch

Release date: 2015

Set in the Wyoming wilderness in 1989, *Firewatch* is the product of a kind of indie developer supergroup: Sean Vanaman and Jake Rodkin from Telltale's *The Walking Dead*, and *Mark Of The Ninja* lead designer Nels Anderson are working in collaboration on this first-person adventure. Expect plenty of player choice and walkie-talkie dialogue.

» **Publisher**: Panic
» **Developer**: Campo Santo

For Honor

Release date: TBD

Powered by Ubisoft's own AnvilNext engine—you know, the one that makes things look mouthwatering but had a hard time keeping people's faces on their bodies in *AssCreed Unity*—it's perhaps best described as a shooter with swords. Historical melee combat's the order of the day in this rare new IP announcement from the conference, and it's shaping up nicely.

» **Publisher**: Ubisoft
» **Developer**: Ubisoft Montreal

Final Fantasy VII Remake

Release date: TBD

Vying for the honor of this year's biggest announcement with *Shenmue 3*, *FFVII Remake* (that's actually its name, for now) answers the prayers of people stuck in the past the world over. Cloud Strife will be super-high poly.

» **Publisher**: Square Enix
» **Developer**: Square Enix

Deus Ex: Mankind Divided

Release date: 2016

OK, *definitely* don't Google this one straight after the *South Park* game. Or at least make damn sure you get the spaces in the right place. Its E3 gameplay would have you believe Adam Jensen is to stealth what boxing gloves are to keyhole surgery, but Eidos Montreal's promising better weapon feedback *and* stealth options from *Mankind Divided*.

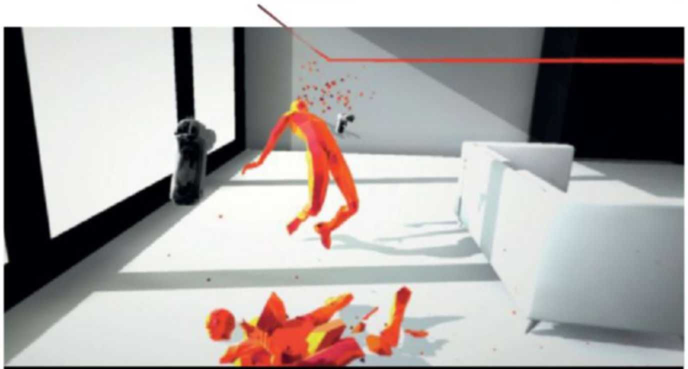
» **Publisher**: Square Enix
» **Developer**: Eidos Montreal

Metal Gear Solid V: The Phantom Pain

Release date: 15 September

A curious alleged split between visionary creator Hideo Kojima and Konami can't sour *The Phantom Pain*, an open-world stealther set in Africa and Afghanistan. It's bejeweled with the series's trademark, immaculate sneaking mechanics and offbeat humor—a command that instructs your horse to do a poo, for example, or the sexy girl cardboard cutout decoy.

» **Publisher**: Konami » **Developer**: Konami/Kojima Productions



Superhot

Release date: December 2015

Systemic open worlds, iconic characters, prestigious franchises... none of these were in short supply at the Los Angeles Convention Center this year. But good ideas? *New* ideas? Considerably rarer. *Superhot*, an FPS in which time only moves when you do, is in possession of that rarest commodity; an idea so good you want to play it immediately upon reading it.

» **Publisher**: Superhot Team
» **Developer**: Superhot Team

Trackmania Turbo

Release date: 27 November

Not to be confused with the handheld spin-off of the same name, French developer Nadeo's latest arcade racer integrates a random track generator and a "two players, one car" control method. If you ever tried to play *Octodad* in co-op, you'll get the gist (and lose a friend). As ever, outlandish layouts and devilish puzzle elements are looking rock-solid.

» **Publisher:** Ubisoft
» **Developer:** Nadeo

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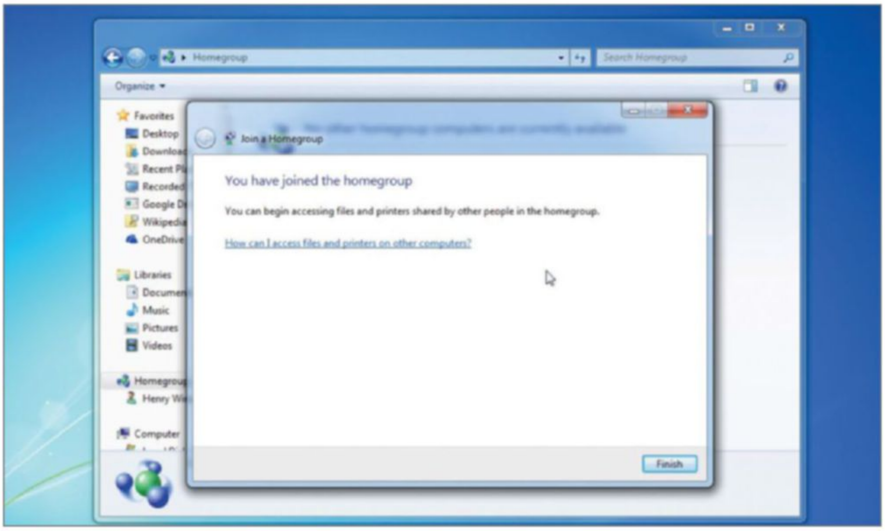
WINDOWS TIP OF THE MONTH



You have joined the homegroup

You can begin accessing files and printers shared by other people in the homegroup.

How can I access files and printers on other computers?

QUICKLY SET UP A HOMEGROUP

If you've multiple Windows computers connected to your Wi-Fi router, you've got the ingredients for HomeGroup. These closed networks let you share files between PCs. You can even stream music and videos. Simply enter the Control Panel, type "homegroup" in the search panel, then click the result. Next, click "Share with other home computers running Windows 7" (it works with Win8, too), then follow the steps.

MAKE – USE – CREATE

60
Create a Raspberry Pi 2 server

Virtual Router Manager v1.0

65
Make your laptop a wireless hotspot

66
Build a mini Dream Machine

ANDREW WESTBROOK
CONTRIBUTING EDITOR

WELCOME TO THE FUTURE

Finally, the hype machine can take a break. Windows 10 is here and there's much to be excited about. Features such as a Start menu that makes sense, plenty more Cortana fun, and the prospect of DirectX 12. Best of all, it seems to achieve what an OS is actually supposed to achieve: improving productivity, not frustrating it.

Added to that is one of the headline attractions, Internet Explorer replacement Edge. Billed as being minimalist and clean, with enticing features such as Cortana integration and reading mode, Edge was supposed to be a break from the much-maligned (if sometimes unfairly) name that was IE. But then Microsoft revealed the Edge logo. Which is basically the old IE logo. Excitement, it did not inspire.

But I get it. A big part of Win10's success will lie in keeping the PC masses happy. A touch of familiarity goes a long way. Luckily, it doesn't detract from what Edge delivers. One of the more fun innovations is annotating webpages. It's easy to do. Click the "Web Note" icon in the top-right to bring up a new purple bar. Choose a pen, color, or text box from the options on the left, and get scribbling. Once finished, buttons in the top-right let you save or share your musings. It's simple, but it's progress. Symbolic, hopefully, of Windows 10 as a whole.

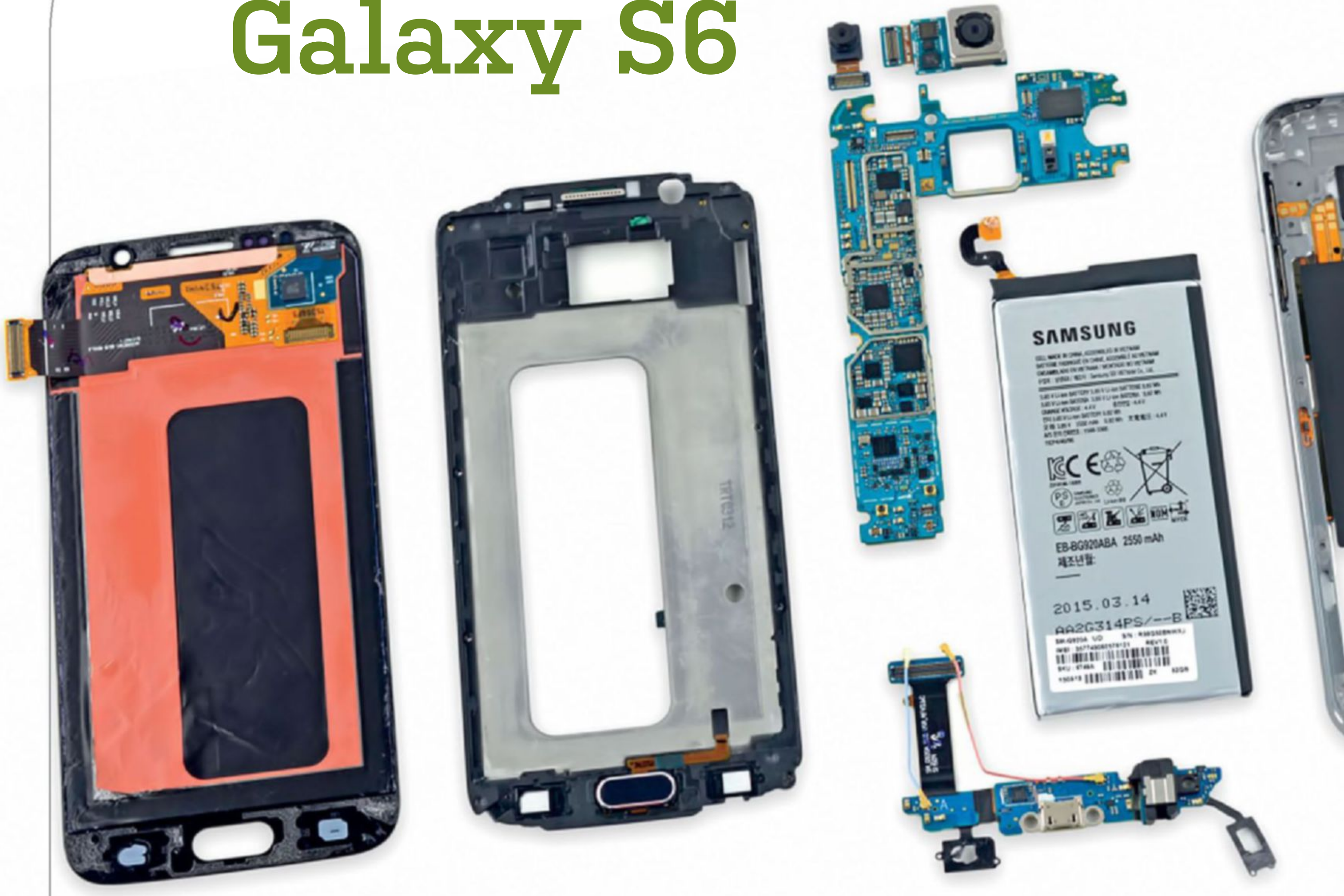
↘ submit your How To project idea to: comments@maximumpc.com

IFIXIT presents:

AUTOPSY

THIS MONTH WE DISSECT...

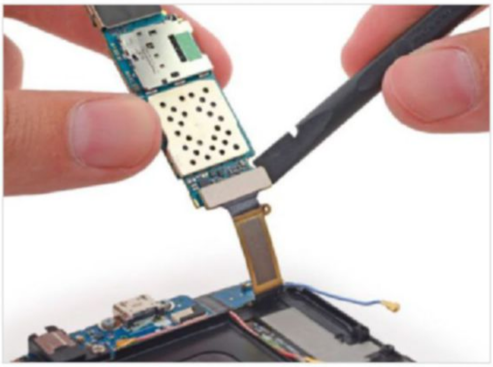
Samsung Galaxy S6



About iFixit

iFixit is a global community of tinkerers dedicated to helping people fix things through free online repair manuals and teardowns. iFixit believes that everyone has the right to maintain and repair their own products. To learn more, visit www.ifixit.com.

You certainly need more than a rock and a piece of string to put this Galaxy back together.



The motherboard is still held by the gravitational pull of a pesky daughterboard connector.

BACKGROUND:

Samsung's Galaxy line of smartphones used to fare quite well in the repairability department, but last year's flagship S5 model took a tumble, scoring a meh-inducing 5/10. Will the newly redesigned S6 lead us back into star-studded territory, or will we sink further into the depths of a repairability black hole? Hop aboard as we tear down the Samsung Galaxy S6.

MAJOR TECH SPECS:

- 5.1-inch Super AMOLED capacitive touchscreen (1440x2560 at 577dpi)
- Exynos 7 Octa 7420 Processor with integrated Mali-T760 GPU
- 3GB RAM; 32/64/128GB on-board storage
- Built-in wireless charging
- 16MP rear camera with HDR, LED Flash, and dual video recording
- Corning Gorilla Glass 4 Backing

KEY FINDINGS:

- The S6 Edge was monstrously hard to open, and odds are the S6 has the same nasty adhesive. This Galaxy looks sleek and talks tough, but we're packing heat in the form of an adhesive-softening iOpener. After wrestling with a bout of déjà vu, a heavy-duty suction cup and opening pick get us in.
- Removing the battery from the S6 should be a little easier than from the Edge. With the extra room inside the regular S6, Samsung was able to run the cable on top of the board, to save a step for battery removal. Also, thanks to the flat-screen design of the S6, it's easier to push an opening pick straight into the gap between the battery and display assembly, making it simpler to cut the adhesive.
- The S6's 5MP selfie camera is the spitting image of the front-facing camera we found in the Edge. The similarities don't end there. The 16MP OIS rear-facing camera looks nearly identical to the one in the Edge.
- We attempt to pry up the daughterboard, but are thwarted by soft-button LED cables. The cables are trapped between the display and the display-backing frame. So we pry up the display frame to release the daughterboard.
- Once extricated, the daughterboard provides a clear view of its audio jack and space-aged micro-USB (2.0) port. This represents another seeming step backward from the S5, which packed a 10x faster USB 3.0 port.
- Repairability Score: 4 out of 10 (10 is easiest to repair). The S6 doesn't have the S5's display-first entry, but the display still needs to be removed if you want to replace the USB port. Front and back glass makes for double the crackability, and strong adhesive on the rear glass makes it very difficult to gain entry into the device.

Build a Raspberry Pi 2 Server

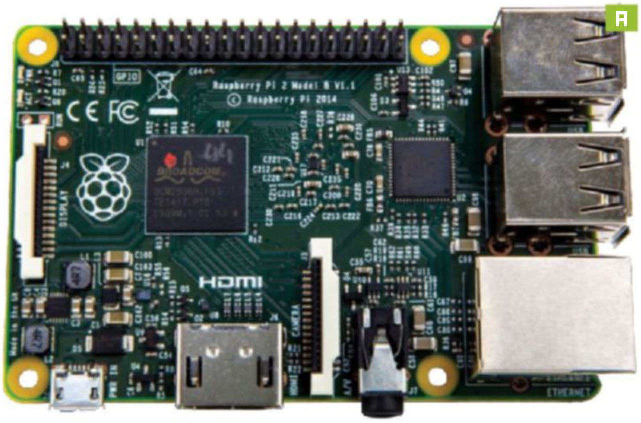
YOU'LL NEED THIS

RASPBERRY PI 2
The great mini-computer costs $42. See www.raspberrypi.org.

MICRO SD CARD
You'll need a blank card to hold Raspian, the OS (or distro) for the Pi.

TRADITIONALLY, SERVERS ARE great big devices that consume vast amounts of power and generate a considerable amount of heat. That's why data centers are huge, air-conditioned rooms full of racks housing multiple units. But for home or small business use, they don't have to be that way, and with the Raspberry Pi, we have a small Linux computer that consumes very little power and generates only a small amount of heat.

In this tutorial, we'll be using a Raspberry Pi 2 to build a small, powerful, and energy-efficient server that will be a handy remote backup location and will serve files over SSH, a secure protocol that provides a level of encryption to your connection, giving you a more secure method of transporting data over the Internet. Other than the hardware listed to the left, you'll also need a good-quality Raspberry Pi power supply, an Ethernet connection to a router, and an externally powered USB hard drive. **–LES POUNDER**



1 INSTALL RASBIAN

We'll start by creating an SD card containing the operating system. Technically, this is a bundled collection of software based on the Linux kernel that's called a distribution, or "distro" for short. Our distro of choice is Raspbian, which is the default distro for the Raspberry Pi [**Image A**].

» There are two ways of installing Raspbian to your SD card. First, the NOOBS method requires you to download the NOOBS ZIP archive and then extract the contents to a blank, FAT-formatted card. Once this card is inserted into your Pi, a menu will ask you which distro to install. This is where you should choose Raspbian, and then grab a coffee while it installs itself. This is the easiest way of installing Raspbian, but for a smaller install footprint, the best method is to download the Raspbian image directly and then extract it from the archive, copying the image over to a blank SD card.

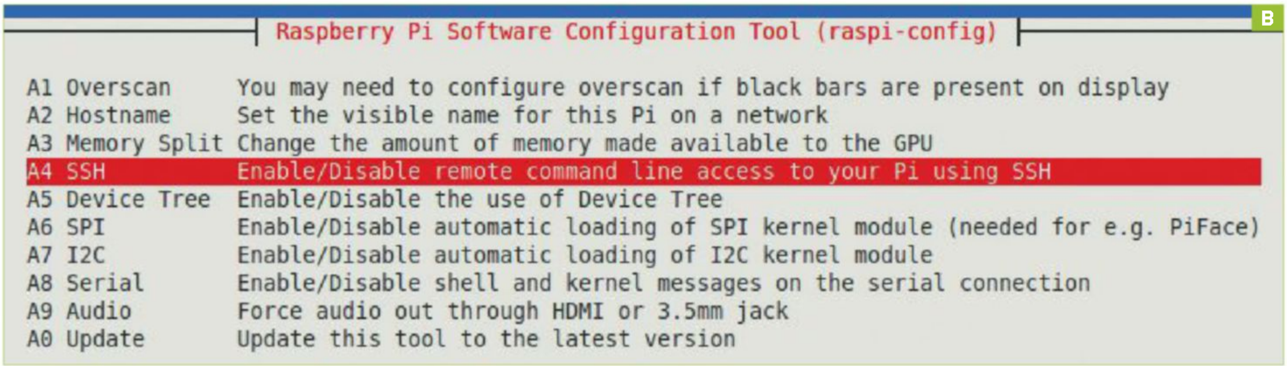
» Start by downloading the Raspbian Debian Wheezey distribution from http://raspberrypi.org/downloads. This is a reasonably big file—it's just under 1GB—so this is probably a good time to grab yourself a refill coffee (depending on your connection). Once it has downloaded, extract the image file to your desktop. The image file will have a .img extension.

2 FIND YOUR SD CARD

Insert the microSD card into your SD card reader and check that it has a drive letter assigned, so that Windows can see the drive in explorer. Take a look in the Disk Manager tool if you're having problems on this front.

» Next you'll need to download the Win32DiskImager utility (http://sourceforge.net/projects/win32diskimager) and extract that to your desktop as well. You can now right-click the executable of the disk imager utility and select "Run as administrator."

» Select the image file you extracted in Step 1. Next you need to select the drive letter of the SD card in the "Device" box. Make sure you get this right as it deletes the contents of the drive as part of the writing process. Click the "Write" button and wait for the image to be copied across. Once done, exit the imager, and eject your SD Card.



```
Raspberry Pi Software Configuration Tool (raspi-config)

A1 Overscan      You may need to configure overscan if black bars are present on display
A2 Hostname      Set the visible name for this Pi on a network
A3 Memory Split  Change the amount of memory made available to the GPU
A4 SSH           Enable/Disable remote command line access to your Pi using SSH
A5 Device Tree   Enable/Disable the use of Device Tree
A6 SPI           Enable/Disable automatic loading of SPI kernel module (needed for e.g. PiFace)
A7 I2C           Enable/Disable automatic loading of I2C kernel module
A8 Serial        Enable/Disable shell and kernel messages on the serial connection
A9 Audio         Force audio out through HDMI or 3.5mm jack
A0 Update        Update this tool to the latest version
```

3 SETTING UP RASPI-CONFIG

With your SD card ready, let's assemble your Raspberry Pi setup. You'll need to plug your Pi into a monitor and have a keyboard and mouse connected. Assemble your kit, insert the SD card, and power up your Pi. The boot process will take less than 15 seconds. You'll then be transferred to the raspi-config screen.

›› Your first task is to expand the filesystem on the SD card so you get the max amount of space. To do this, navigate to "option 1" and hit Enter to start an automated process. With that complete, navigate to "option 8—Advanced options." Now go to "A3, Memory Split" and press Enter. Change the value to "16," and press Enter. This gives you 16MB of RAM for the GPU. As you'll be using this headless, you won't need a lot of video RAM. You'll be returned to the main menu, but you need to go back to the "Advanced menu—option 8." Once there, navigate to "A4, SSH" [**Image B**], move the cursor to "Enable," and press Enter. That's our configuration done. Return to the main menu, navigate to "Finish," and press Enter. Reboot your Raspberry Pi to finish the configuration.

4 LOGGING IN

With the Pi rebooted, go ahead and log in. The default username is "pi" and the password is "raspberry." Next, ensure your software is up to date. At the LXTerminal, type in the following and press Enter.

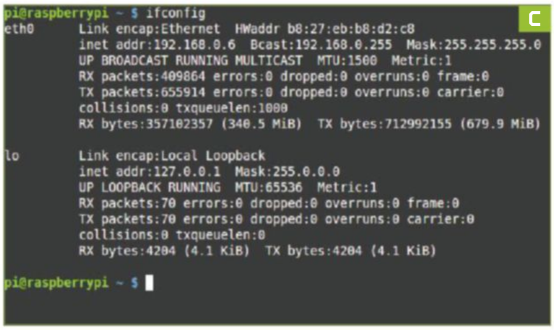
```
sudo apt-get update
```

›› This will compare your software repository lists against what's on the Raspbian servers and update it where it needs to. If there's a lot to download, Raspbian will ask before it does so. Depending on your Internet speed, this may take a while.

5 GETTING A FIXED IP

With the updates complete, create a fixed IP address for the Pi server. You'll need to edit the "/etc/network/interfaces" file. You'll need to know the Pi's IP address. Find it by running:

```
ifconfig
```


C

```
pi@raspberrypi ~ $ ifconfig
eth0      Link encap:Ethernet  HWaddr b8:27:eb:b8:d2:c8
          inet addr:192.168.0.6  Bcast:192.168.0.255  Mask:255.255.255.0
          UP BROADCAST RUNNING MULTICAST  MTU:1500  Metric:1
          RX packets:409864 errors:0 dropped:0 overruns:0 frame:0
          TX packets:655914 errors:0 dropped:0 overruns:0 carrier:0
          collisions:0 txqueuelen:1000
          RX bytes:357102357 (340.5 MiB)  TX bytes:712992155 (679.9 MiB)

lo        Link encap:Local Loopback
          inet addr:127.0.0.1  Mask:255.0.0.0
          UP LOOPBACK RUNNING  MTU:65536  Metric:1
          RX packets:70 errors:0 dropped:0 overruns:0 frame:0
          TX packets:70 errors:0 dropped:0 overruns:0 carrier:0
          collisions:0 txqueuelen:0
          RX bytes:4204 (4.1 KiB)  TX bytes:4204 (4.1 KiB)

pi@raspberrypi ~ $ █
```

›› This will spit out a lot of text. As you're using the Ethernet connection, look for the "eth0" line, typically at the top of the text. In this section, look for the "inet addr:." Ours looks like this [**Image C**]:

```
eth0    Link encap:Ethernet  HWaddr b8:27:eb:b8:d2:c8
inet addr:192.168.0.6  Bcast:192.168.0.255
Mask:255.255.255.0
```

›› We also need to run "netstat" to get more details:

```
netstat -nr
```

›› And pick out two numbers from here for the gateway and the destination. Make a note of both. Next, edit the "/etc/network/interfaces" config file.

```
sudo nano /etc/network/interfaces
```

›› The default configuration will show that interface eth0, Ethernet, is using DHCP (Dynamic Host Configuration Protocol). In other words, it will get an IP address each time it connects to the router:

```
iface eth0 inet dhcp
```

›› To keep track of our Pi server on the network, we'll fix its IP to what we found in "ifconfig," which in our case was 192.168.0.6. Yours will differ. We'll make changes only to the "iface eth0" section; leave the others as they are.

CREATE A NETWORK PRINTER

We tend to have multiple computers in our homes these days, but when we want to print, we only have one printer. So, what if we could create a central network printer using our Raspberry Pi server? Well, we can, using Common Unix Printing System, or CUPS, a printing service created by Apple and used on OS X and Unix systems around the world.

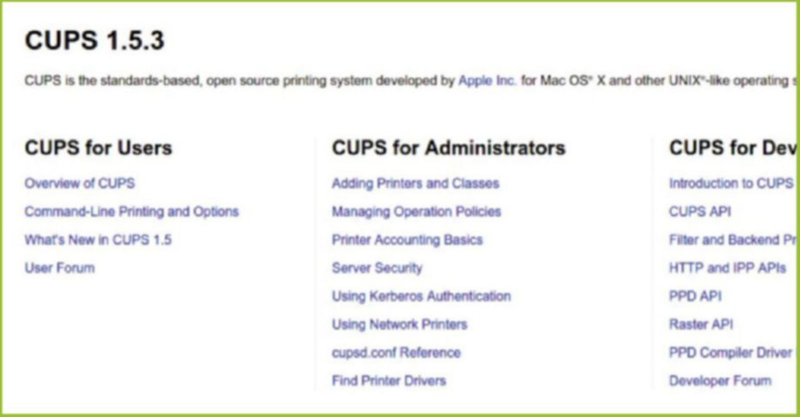
We typically run a version of CUPS on our computer, but we can also instruct our computer to print to a network printer. To install CUPS, you'll need to SSH into your Pi server and type the following into the LXTerminal:

```
sudo apt-get install cups
```

You'll then need to complete a few configuration changes. We found a really good guide for this on How-To Geek (http://bit.ly/LXF198-cups) that shows how to complete this task on your Pi. To administer a remote CUPS printer, all you need to do is open a browser on your computer, type in the IP address for your Pi server, and append :631 to it:

```
192.168.0.6:631
```

You can then add new printers, check the status of print jobs, and cancel any erroneous prints. You can even set up an extreme remote print job by using port forwarding on your router to forward print jobs from outside your network to the CUPS printer.


CUPS 1.5.3

CUPS is the standards-based, open source printing system developed by Apple Inc. for Mac OS® X and other UNIX®-like operating

CUPS for Users

Overview of CUPS
Command-Line Printing and Options
What's New in CUPS 1.5
User Forum

CUPS for Administrators

Adding Printers and Classes
Managing Operation Policies
Printer Accounting Basics
Server Security
Using Kerberos Authentication
Using Network Printers
cupsd.conf Reference
Find Printer Drivers

CUPS for Dev

Introduction to CUPS
CUPS API
Filter and Backend Pr
HTTP and IPP APIs
PPD API
Raster API
PPD Compiler Driver
Developer Forum

CUPS comes with an easy-to-use admin page that enables you to remotely administer your network printer and manage/install new printers via a wizard.

» Our new section looks like this, yours will reflect the setup of your network:

```
iface eth0 inet static
#The IP address that we wish to use
address 192.168.0.6
#This is used to divide IP addresses into subnets, this is the
standard and will work for you
netmask 255.255.255.0
#This is the IP address structure for our network, yours might
be 192.168.1.0
network 192.168.0.0
#We found this via ifconfig earlier it was labelled BCAST
broadcast 192.168.0.255
#This is the gateway address that we found in netstat -nr
gateway 192.168.0.1
```

» When you're ready, save the changes by pressing CTRL–O, then exit using CTRL–X.

6 CHECK NETWORK SETTINGS

Next, reboot your Raspberry Pi by typing:

```
sudo reboot
```

» Your Raspberry Pi will reboot and return you to the login prompt. Log back in and type:

```
ifconfig
```

» Check that your IP address is now static; if you want to check that you have Internet access, type the following:

```
ping google.com
```

» If the pings return properly, you've configured the network settings correctly. At this stage, you can carry on using the keyboard and monitor, or you can go headless and connect to your Pi server over the network. We chose to log in via SSH from our Linux Mint laptop. If you're going to do the same, you'll need to open a terminal on your computer and type:

```
ssh pi@IP ADDRESS
```

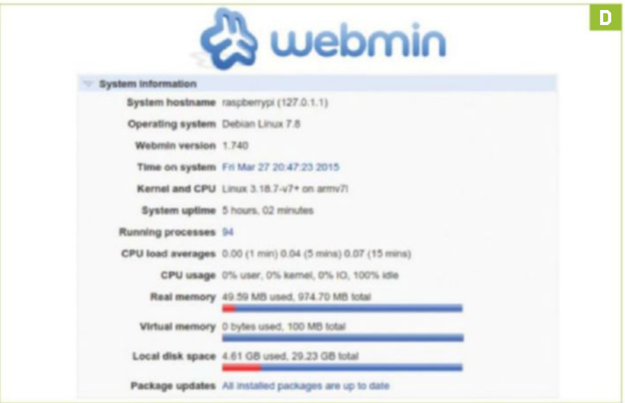
» Remember to replace the IP address with the static address that we used previously. You'll need to provide your password before you can log in, but once successful, any command issued will go through on the Raspberry Pi.

7 ENABLE READ AND WRITE

With your system built, you now need to configure it to act as a server, and the first task is to enable Raspbian to read and write our USB 2.0 external hard drive. If a drive is formatted as a typical Linux filesystem—ext3, ext4, or btrfs—you can read the drive with no configuration necessary. But because this drive is formatted NTFS—a Windows filesystem—you need to install a tool to enable read and write access to the drive, and this is called NTFS-3G. To install, type the following into the LXTerminal:

```
sudo apt-get install ntfs-3g
```

D



System hostname	raspberrypi (127.0.1.1)
Operating system	Debian Linux 7.8
Webmin version	1.740
Time on system	Fri Mar 27 20:47:23 2015
Kernel and CPU	Linux 3.18.7-v7+ on armv7l
System uptime	5 hours, 02 minutes
Running processes	94
CPU load averages	0.00 (1 min) 0.04 (5 mins) 0.07 (15 mins)
CPU usage	0% user, 0% kernel, 0% IO, 100% idle
Real memory	49.59 MB used, 974.70 MB total
Virtual memory	0 bytes used, 100 MB total
Local disk space	4.61 GB used, 29.23 GB total
Package updates	All installed packages are up to date

» It will take a few seconds to install, and when complete, control will be returned to you.

8 INSTALL WEBMIN

Administrating a server is traditionally undertaken via the terminal, in our case LXTerminal. In fact, we've done quite a lot of this already. However, to make administrating a server a little easier, there's a great tool called Webmin [**Image D**]. This is a web interface for common administration tasks, such as user management and updating software.

» To install Webmin on your Pi server, you'll need to use the APT package manager to download Webmin and its dependencies.

```
sudo apt-get install webmin
```

» With Webmin installed, open a new browser window on your computer and navigate to the IP address of your Pi and use the port number '10000'. Our IP address looked like this: 'https://192.168.0.6:10000/'.

» You may receive a warning that the certificate for the website isn't to be trusted. If so, there's no need to worry about it. Just click "Advanced Options" and proceed onward. You'll next see a login screen—enter the username and password you've used to log in to your Pi previously. Once logged in, you'll see the main menu split into eight sections. For this project, refer to the System section, which contains controls for managing hard disks and for managing users and groups.

ANOTHER PI TUTORIAL NEXT MONTH

9 MOUNT DRIVE ON BOOT

The next task is to mount the external USB hard drive on boot, so you'll need the USB drive plugged in to the USB port of the Raspberry Pi. Before you manage the drive with Webmin, you'll need to return to the LXTerminal and create a directory that will act as a share point. In the terminal, navigate to "/media/" and create a new directory called "drive," as follows:

```
cd /media
sudo mkdir drive
```

» With the directory created, you now have an issue: Only users with sudo access, or root, can use the directory. You need to change the permissions so that users can read and write to the hard disk. To do this in the LXTerminal, type the following:

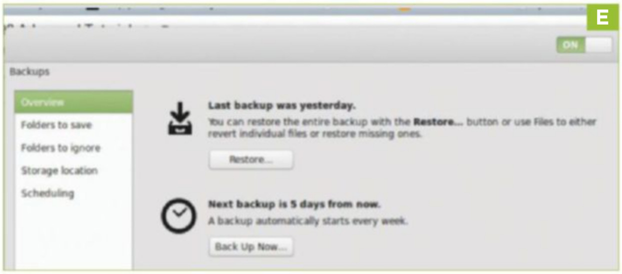
```
sudo chmod 770 ./drive
```

» That's it for now in the terminal, so let's return to Webmin. To manage USB drives with Webmin, click the "System" drop-down menu on the left of the screen, then click "Disk" and "Network Filesystems." After a few seconds, the screen will change and a list of all the mounted filesystems will be displayed.

» Our drive will not be listed, so we need to create a new mount using "Add Mount;" but before you click on the button, look to the right and you'll see a drop-down labeled "Apple Filesystem (HFS)." Click it and select "Windows NT Filesystem NTFS," if your drive is formatted using NTFS. If not, select the format of your drive accordingly. Once selected, click "Add Mount" to open a new menu.

» In the new menu, start by clicking "Mounted As" and its "..." button to the right. This will open a dialog box where you can navigate to the "/media/drive" directory we created earlier. For the rest of the configuration, follow this simple checklist:

- Save Mount? Save and Mount at Boot.



Last backup was yesterday.
You can restore the entire backup with the **Restore...** button or use Files to either revert individual files or restore missing ones.

Next backup is 5 days from now.
A backup automatically starts every week.

- Mount Now? Mount.
- Windows NT Filesystem: Disk. Look for your device in the dropdown menu.
- Mount Options.
- Read-only? No
- Allow users to mount this filesystem? Yes
- Disallow execution of binaries? If mountable by users
- Avoid updating last access time? No
- Buffer writes to filesystem? Yes
- Disallow device files? If mountable by users
- Disallow setuid programs? If mountable by users
- Wait until network interfaces are up? No
- User files are owned by: Leave blank
- Group files are owned by: Leave blank

›› When you're ready, click "Save" to write these configuration settings and mount the drive. The drive will now be available for you to connect to over the network. If you're using Ubuntu or Linux Mint, you can use the file manager to connect to the server, but you can also use Gigolo. (Its tagline is: "It mounts what it is told to." Classy.) This is a graphical front-end for the virtual filesystem GIO/GVFs, which mounts remote filesystems and opens them in your file manager. This will be available to you via your software repositories.

10 BACK UP USING DÉJÀ DUP

For the final part of this project, we'll use our Raspberry Pi server as a remote backup device, with a great piece of open-source software called Déjà Dup (https://launchpad.net/deja-dup). This is a graphical front-end for the flexible, speedy, and scriptable rysnc, which has grown into a standard Linux utility. It makes backing up really easy. To start with, you'll need to install Déjà Dup on your Linux PC. You don't need to install anything on your Pi server. On your computer, open a terminal and type:

```
sudo apt-get install deja-dup
```

›› Once installed, open Déjà Dup and you'll be presented with the Overview screen [**Image E**]. Instruct Déjà Dup which folders you wish to back up—that's in the "Folders To Save" option. Once you've done that, move to the "Storage Location" menu and fill in the details for your Pi server, including the location to store your backup. We used "/media/drive/Documents," which was an existing folder on the drive. With that complete, you're ready to navigate back to the Overview and click "Back Up Now."

›› Your first backup will take longer than subsequent backups, due to it being a full backup of the directories you've selected, while future backups will only cover changes to those files. To restore from a backup, go to "Overview," click "Restore," then follow the wizard.

›› So, there we have it. We've built a server that uses very little power, but centralizes our files and provides a remote backup solution for our digital lives—all thanks to the Raspberry Pi and a little Linux know-how.

ACCESSING YOUR PI SERVER

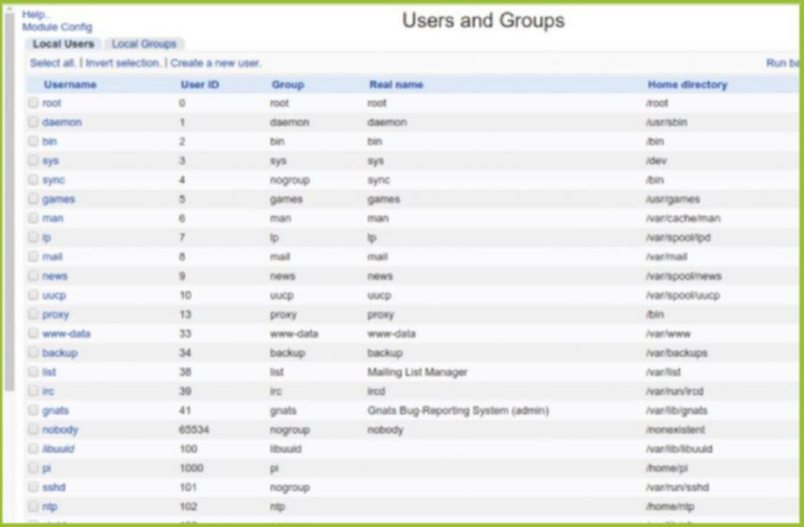
In this project, we've created a file server inside our home network that's not accessible to anyone outside. If you'd like to enable your Pi server to be accessed by external users, then there are a number of things you'll need to do.

Start by changing the default password for the Pi user you want to give access to. You can do this using the "passwd" command in LXTerminal. Next, create a new user with no sudo or root privileges. It's easiest to do this via the "System → Users and Groups" menu.

Now, set up port forwarding on your router so that requests to your external IP address are forwarded to the Raspberry Pi server. This is a little different for every router, so please consult your router manual.

It's likely that your ISP doesn't provide a static external IP address. If that's the case, head to http://bit.ly/No-ipLinux and install noipclient, then create an account on its website (www.noip.com). The client software will update your IP address to a URL that you create on the website. This will enable you to easily connect to your server without having to use an IP address.

Finally, it's really important to set up a firewall that will protect your server from external interference. The easiest way to do this is install fwbuilder and VNC on the server, as fwbuilder is a GUI application to set up the firewall rules.



Users and Groups

Username	User ID	Group	Real name	Home directory
☐ root	0	root	root	/root
☐ daemon	1	daemon	daemon	/usr/sbin
☐ bin	2	bin	bin	/bin
☐ sys	3	sys	sys	/dev
☐ sync	4	nogroup	sync	/bin
☐ games	5	games	games	/usr/games
☐ man	6	man	man	/var/cache/man
☐ lp	7	lp	lp	/var/spool/lpd
☐ mail	8	mail	mail	/var/mail
☐ news	9	news	news	/var/spool/news
☐ uucp	10	uucp	uucp	/var/spool/uucp
☐ proxy	13	proxy	proxy	/bin
☐ www-data	33	www-data	www-data	/var/www
☐ backup	34	backup	backup	/var/backups
☐ list	38	list	Mailing List Manager	/var/list
☐ irc	39	irc	ircd	/var/run/ircd
☐ gnats	41	gnats	Gnats Bug-Reporting System (admin)	/var/lib/gnats
☐ nobody	65534	nogroup	nobody	/nonexistent
☐ *libuuid*	100	libuuid		/var/lib/libuuid
☐ pi	1000	pi		/home/pi
☐ sshd	101	nogroup		/var/run/sshd
☐ ntp	102	ntp		/home/ntp

Webmin can also manage users and groups via its graphical interface, and is a lot easier than the terminal for those new to server administration.

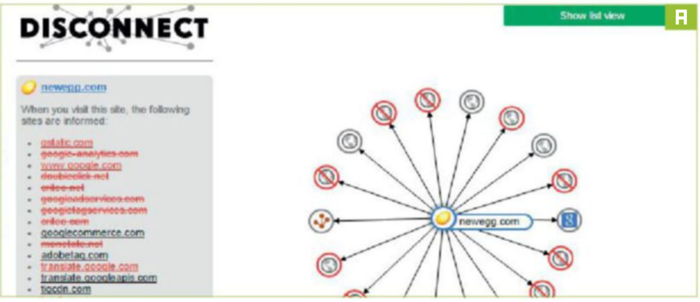
Pick The Best Chrome Extensions

YOU'LL NEED THIS

GOOGLE CHROME
Download the free browser from www.google.com/chrome/.

GOOGLE'S CHROME, according to gs.statcounter.com, is the world's most-used Internet browser. Indeed, despite all the tech snobbery and occasional backlash at Google for its buggy Android updates, we'll admit it's our favorite, too. The main reason is its ability to work with all sorts of extensions, some of which dynamically change the way you view your regular online content. Other browsers, such as Firefox, Safari, and Opera, do support extensions, but Google's library remains by far the largest and most comprehensive. Read on for our top 10 Chrome extensions.

–ZAK STOREY



newegg.com

When you visit this site, the following sites are informed:

- gstatic.com
- ~~google-analytics.com~~
- www.google.com
- ~~doubleclick.net~~
- ~~criteo.net~~
- ~~googleadservices.com~~
- ~~googletagservices.com~~
- ~~criteo.com~~
- googlecommerce.com
- ~~monetate.net~~
- adobetag.com
- translate.google.com
- translate.googleapis.com
- tiqcdn.com

A

1 HTTPS EVERYWHERE

This is by far the best plugin for the more security conscious. HTTPS Everywhere acts as a toggle, ensuring that any website you visit with access to HTTPS will immediately switch your browser from the default HTTP Internet protocol to HTTPS. As a result, your browser encrypts all communication between your PC and the site in question, meaning those nosey government agencies have a far harder time getting your personal details and activities. http://bit.ly/httpsEW

2 DISCONNECT

Similar to HTTPS, Disconnect is all about privacy, and gives you a fancy little infographic as well [Image A]. It essentially blocks all incoming requests to track your movements across the Internet for advertising purposes. Stop personalized ads dead in their tracks. And yes, even if you've got an Adblocker running, you might as well take it one step further and leave as minimal a footprint as possible. http://bit.ly/DisConnecT

3 ADGUARD ADBLOCKER

Adguard Adblocker does exactly what it says on the tin. Although yes, advertising does provide a lot of people with income (ourselves included, to a degree), the endless ads that invade our personal online experience should kindly go the way of the dinosaur. We can get behind hard-coded advertising that is relevant to what we want, but otherwise, nope, we'll pass thanks. http://bit.ly/AdGuardBlocker

4 BITDEFENDER TRAFFICLIGHT

Another very handy tool for increasing your online security, this extension actively prevents you from going on any website with malware or phishing activity, while giving you the option to continue to the site if you really want to. It's especially useful if you're more inclined to opt for a free antivirus solution. http://bit.ly/BitDefTrafLight

5 PHOTO ZOOM FOR FACEBOOK

Simply hover over any photo or link on Facebook and the extension will automatically show you the fully expanded image on the fly, without opening a new link or browser. Think of it as a fast Facebook photo preview. http://bit.ly/PhotoZoomFB

6 TWEETDECK

Ideal for power Twitter users. It's best utilized with lists, which are the smart way to group people you follow (and even people you don't) into separate groups to monitor what they tweet. Be warned that they can see what group you add them to and what that group is called! http://bit.ly/TweetDeckChrome

7 MAGIC ACTIONS FOR YOUTUBE

Enhance your YouTube experience with a host of different options condensed into one app. Once you're past the tricky install bar, head to Options and you'll find access to Auto HD, Auto Wide, Bypass Country Restrictions, and a few other options. Change your YouTube to dark mode by flicking the light switch in the top left. A great suite. http://bit.ly/YouTubeActions

8 SUBSCRIPTIONS GRID FOR YOUTUBE

This love-it-or-hate-it extension offers a subtle modification, but we're fans. It changes the "My subscriptions" page on YouTube to a grid layout as opposed to a list, allowing you to see multiple videos at once. http://bit.ly/SubGrid

9 SPEED DIAL 2

If you want dedicated websites, instead of having Google show your most-visited websites, then this extension lets you customize what links appear on your new tab page, and what background you use (including your own uploadable ones). It even shows how many times you click on each of those websites (which we disabled pretty quickly!). http://bit.ly/SpeedDial2EX

10 GOOGLE MAIL CHECKER

An old classic. This adds a small Gmail icon to the top right of your Chrome's Taskbar. Other than being a hyperlink to Gmail, it also dynamically updates and notifies you when you have new messages. It's synced to your logged-in account, however, so it's less beneficial if you use multiple Gmail accounts. http://bit.ly/GMailCheck

Make Your Laptop A Wireless Hotspot

YOU'LL NEED THIS

VIRTUAL ROUTER
Download the open-source hotspot software from http://bit.ly/1zo1lQJ.

USING YOUR LAPTOP TO SHARE ITS WIRELESS NETWORK connection—turning it into a wireless hotspot—is easy. It means you can connect other devices to the network via your laptop, handy if you've an aging router. Most laptops have decent Wi-Fi adapters, and by hooking your laptop to a router via an Ethernet cable, you can create a powerful Wi-Fi network that can reach all corners of your home. Likewise, if you're in a hotel overseas that offers a wired Internet connection, you could create a hotspot and then connect your smartphone, meaning you can browse the web without incurring roaming charges. Best of all, it's not only easy, it's free! –MATT HANSON

1 GET THE SOFTWARE

We'll be using the free software Virtual Router. First you'll need to download it, so head to http://bit.ly/1zo1lQJ and click the large "download" button on the right-hand side of the screen [**Image A**]. When prompted, "Save" the program, then select "Run."

2 INSTALL VIRTUAL ROUTER

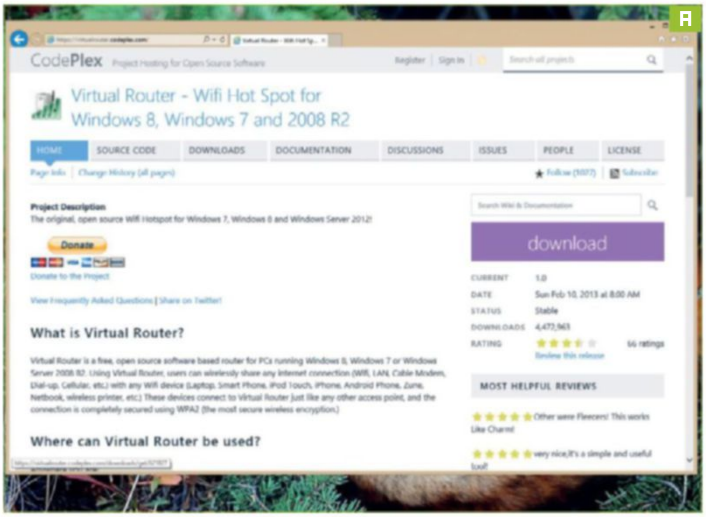
Now go to the Virtual Router setup. Click "Next" and you'll be asked where you want to install the software. You can select whether you only want your user account to access the program, or every user account. If you don't want others making networks, select "Just me."

3 NAMING YOUR NEW NETWORK

Once it's installed, a window will appear asking for a network name, or SSID. The default name is VirtualRouter.codeplex.com, but you can personalize this. It's worth making it memorable, bearing in mind you'll be searching for it on your other wireless devices. This is also where you choose your password.

4 CHOOSE WHICH NETWORK TO SHARE

The next box lets you choose which network to share. By default, it will be on "None," so click the dropdown box to see a list of connections you can share. The amount of connections available will depend on how your laptop is connected to your network. Most of the time you should see an option for Wi-Fi, so select this to share your wireless network [**Image B**].


A

CodePlex Project Hosting for Open Source Software

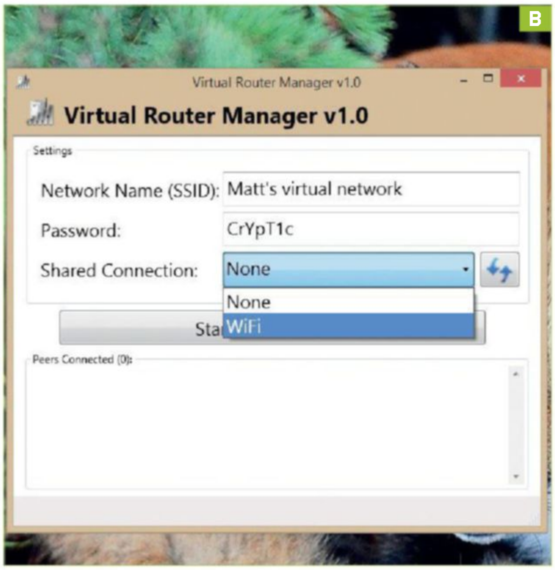
Virtual Router - Wifi Hot Spot for Windows 8, Windows 7 and 2008 R2

Project Description
The original, open source Wifi Hotspot for Windows 7, Windows 8 and Windows Server 2012!

What is Virtual Router?

Where can Virtual Router be used?

CURRENT 1.0
DATE Sun Feb 10, 2013 at 8:00 AM
STATUS Stable
DOWNLOADS 4,472,963


B

Virtual Router Manager v1.0

Settings

Network Name (SSID): Matt's virtual network

Password: CrYpT1c

Shared Connection: None

5 START YOUR VIRTUAL ROUTER

Now click "Start Virtual Router" to turn on your new network. Your laptop will broadcast a new network that your wireless devices can connect to. At the bottom of the window you should see a message that says "Virtual Router Started." In the box above it, where it says "Peers Connected," it should be empty. When you begin connecting devices, you'll see them appear here.

6 CONNECT TO THE HOTSPOT

Now your laptop is broadcasting a new Wi-Fi network that you can connect devices to. The method of connecting will depend on the device, but open the settings and choose the Wi-Fi network. Click on the network and enter the password. You'll see devices you've connected to the hotspot listed in the Virtual Router window.

7 ENJOY YOUR HOTSPOT

While you're running the virtual router, keep an eye on the peers connected window and make sure that there aren't any devices you don't recognize. Also, make sure that everyone connected knows that when you turn off your laptop, the hotspot will also turn off. If you want to turn off your hotspot at any moment, simply click "Stop Virtual Router." ⏻

BUILD IT

ALEX CAMPBELL **ASSOCIATE EDITOR**

Rocket Science

Dream Machine 2015 was pitched at the Moon; this rig aims for low-Earth orbit

LENGTH OF TIME: **1–3 HOURS** LEVEL OF DIFFICULTY: **MEDIUM TO CHALLENGING**

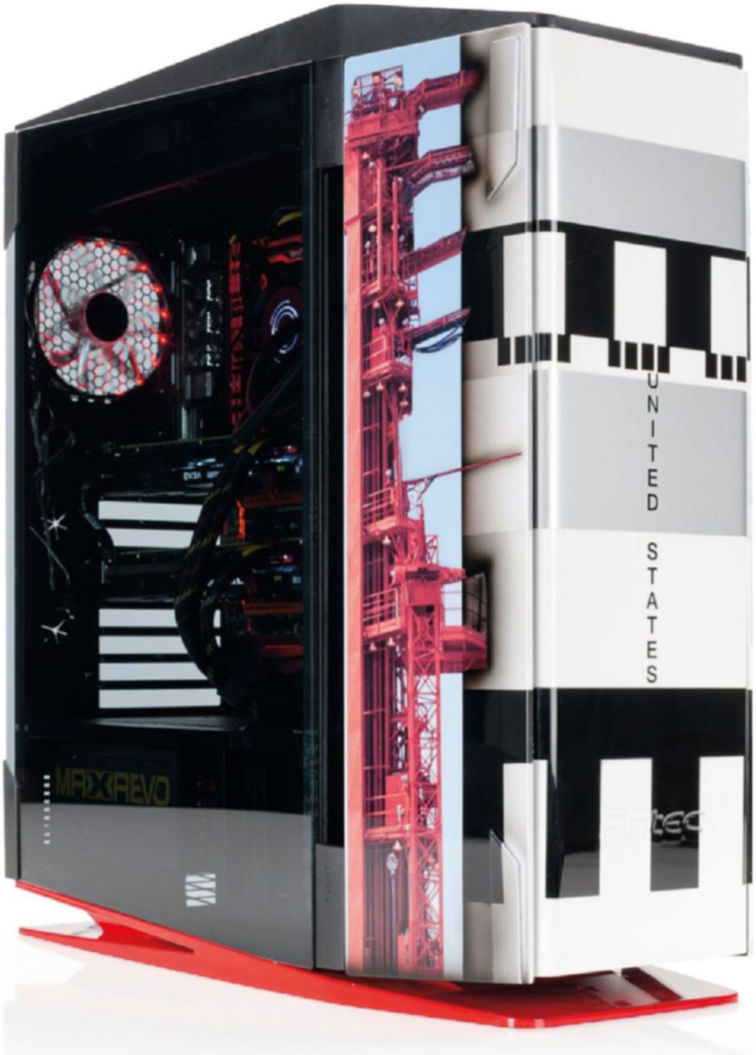
THE FLIGHT PLAN

WHEN WE BUILD the Dream Machine every year, we don't hold back. We get the best parts, regardless of the price. If a part is a tier higher in price, but only renders a performance increase of 5 percent, we go for it. And this year, we really, really went for a Moonshot.

But not everyone can afford a $22,000 Dream Machine for their home. So, in the spirit of our NASA-inspired theme, we decided to go a little smaller. It's pretty much a miniature Dream Machine, with a price point that's a little more down to earth.

We gathered up parts that didn't make it into the Dream Machine for some reason, or that would be a little more sensible in terms of price. Make no mistake: This machine still soars and climbs for excellence. An out-of-this-world PC is still within reach for many enthusiasts who save up their credits. It's not cheap, but no respectable space program is.

Since this is the Dream Machine's little brother, we felt the need to do a little overclocking as well. We weren't able to be as aggressive with our overclocks as the EK custom loop allowed us to be in its big brother, but we still got respectable and stable overclocks. Giving this PC enough extra thrust to leave the atmosphere.



VEHICLE ASSEMBLY

WE BASED THIS BUILD on a case that was meant for the Dream Machine, but ended up being too small for the custom water loops we used. The case was a prototype of Antec's S10 that we had custom painted by Smooth Creations to replicate a Titan II Gemini Launch Vehicle on a launchpad. We went with a Core i7-5930X CPU. It's two cores lighter than the Dream Machine's 5960X, but friendlier to overclocks and your wallet. The 5960X is nearly $500 more, meaning you're paying $250 per extra core. We got a nice stable overclock with our 5930K, bumping it to 4.5GHz from the stock 3.5GHz with the help of 1.31 volts. We kept the main engine cool with an NZXT Kraken X61.

The GPUs are a pair of EVGA GTX 980 Ti Superclocked ACXs in SLI. We overclocked these already factory-overclocked rockets further, adding 150MHz to the core clocks and 300MHz to the memory clocks using EVGA's PrecisionX software. We powered the overclock with an overvolt of 31mV. We used 16GB of 2,800MHz DDR4 memory in a kit of four 4GB modules. We ran into problems at 2,800MHz, so underclocked to 2,666MHz for stability.

For storage, we halved what we had in the Dream Machine. We put the 1TB SSDs in RAID 0 for the OS, and kept the 6TB spinning drives in reserve. We mounted all of these goodies onto Gigabyte's X99 SOC Champion mobo, which has more overclocking options than we knew what to do with. We powered our ship with an 80 Plus Gold certified Enermax 1,350W Maxrevo modular PSU.

INGREDIENTS

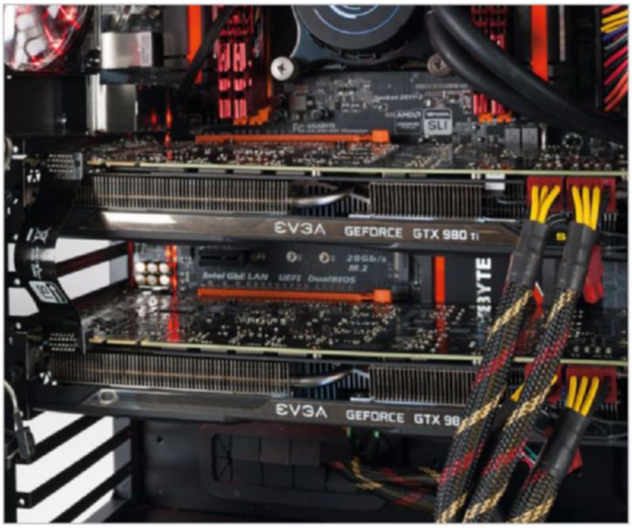
PART		PRICE
Case	Antec S10 Prototype Custom	$500
Motherboard	Gigabyte GA-X99-SOC Champion	$270
CPU	Intel Core i7-5930K	$580
Memory	G.Skill Ripjaws 4 Series 16GB 2800 DDR4	$140
GPU	2x EVGA GeForce GTX 980 Ti SC ACX 2.0	$1,340
PSU	Enermax Maxrevo 1,350W	$320
HDD	2x Western Digital Black 6TB	$700
SSD	2x Samsung Pro 1TB	$1,000
CPU Cooler	NZXT Kraken X61	$140
Fans	3x EK Vardar F4 120mm 2,200rpm fans	$54
Total		$5,044

1

BOOSTER IGNITION

THE PAIR OF 980 Ti'S that we used really push this machine into the ionosphere. The main thing to keep in mind is that they're air cooled. Maintaining good airflow was a top priority when we went into the realms of overclocking. Luckily, the SOC Champion's PCIe x16 slots are numbered (from top to bottom) 1, 4, 2, 3. That means that for the best performance, we had to put the second GPU in the third slot from the top. This gave us a nice gap where air could flow freely, in comparison to the 2–5mm it would have if the cards were in adjacent slots.

We also upped the fan speeds in PrecisionX to 90–100 percent when we were searching for a stable overclock. To be sure, there was a lot of air flowing around these two cards. If you look closely, you'll see that spacing these cards farther apart means that you can add an M.2 SSD if you prefer storage speed over a potential third GPU.



2

CRAMPED QUARTERS

SPACESHIPS AREN'T EXACTLY ROOMY. Engineers cram the most equipment into the tiniest space available to save on weight and profile. This machine was no different. When we attached the Kraken to the top mounting bracket, we had to really push the bracket into place, smashing the CPU power cables a bit. It's secured by two thumbscrews, and lining up those screw holes was a test of mettle and patience.

We could then place intake fans to the front of the case's main compartment to pull in lots of air for our GPUs. The X61 kept our CPU at a cool 25 degrees Celsius at idle, and at 57 degrees while under a 90 percent load, running our Premiere Pro CS6 benchmark.

3

AUXILIARY THRUSTERS

ATTACHING OUR X61 allowed us to mount three fans up front to draw in air. We chose a trio of EK's Vardar static pressure fans, 120mm versions of what's in the Dream Machine. These babies spin at 2,200rpm and push 77 cubic feet per minute (131 cubic meters per hour). We hooked up the top fan to the CPU PWM fan connector (our X61 is hooked into CPU_OPT), and the bottom two to the two spare connectors on the X61. It's worth noting that the retail S10 has a PWM fan hub on the back of the motherboard tray, so doing things this way wouldn't be required.

For benchmarking, we cranked up the power to get air flowing over the 980 Ti's. Boy, did that air flow. The S10 also features a removable filter on the outside of the main compartments in front of the fans. A tab near the base of the S10 releases the filter for removal.

4

MANUAL IGNITION

WHEN WE WERE FIRST TRYING to get Dream Machine parts to fit into this case, we accidentally pulled the front-panel wires loose of the panel buttons and LEDs. Whoops. Luckily, this mobo came with a power button on the board itself. Many modern mobos feature a power button, and they come in handy for things beside compensating for screw-ups, for example, if you're building on a test bed or want to test a particular feature without connecting the front-panel buttons.

There are also buttons to reset the BIOS to defaults, and a toggle that switches to the backup BIOS as well. That sounds trivial, but when you're using all the overclocking features this mobo has to offer, messing up is very possible. Having an easy way to switch to an alternate BIOS or reset to defaults is a good move for tinkerers and overclockers who want to push limits.

5

OPEN THE POD BAY DOORS, HAL

ONE OF THE THINGS that will first catch your eye is the S10's separate tower for hard drives. It seems excessive, but it has a real-world purpose: keeping the ambient temperature of the main compartment low. The tower's doors swing open in the front and rear of the case, making installation easy. The slots for the toolless brackets are rubberized, so drive vibration is absorbed, resulting in longer drive life and less sound from platters spinning at 7,200 RPM.

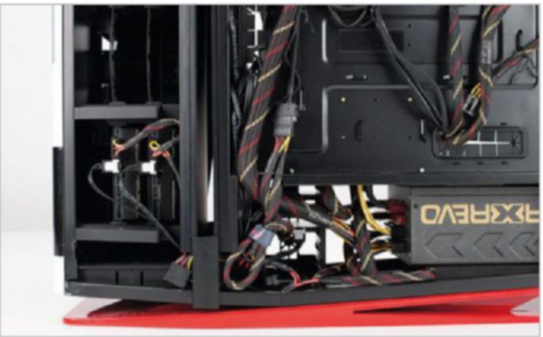
Our pair of 6TB drives were happy, kept plenty cool by a dedicated fan. The fan draws air from under the tower and pushes it up, across the surfaces of the vertically mounted drives. We hooked this fan to the SYS_FAN3 PWM fan header on our mobo, and set the speed to maximum. It stayed quiet at that speed.

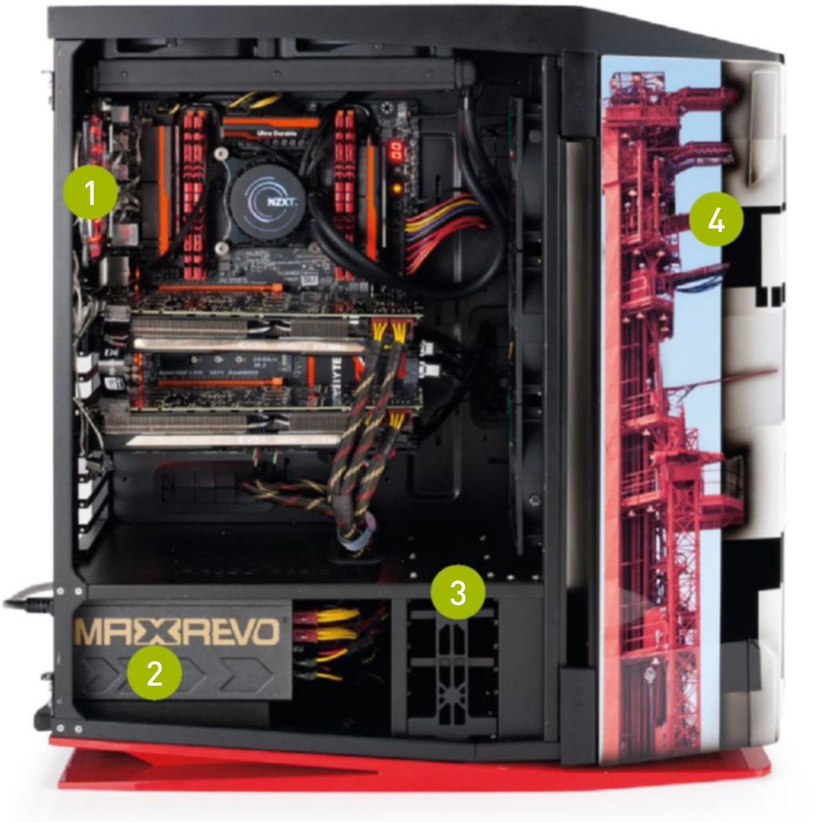
6

CONTROL CONDUITS

WE DON'T OFTEN show cable management in our builds. It's not always pretty. But there's good reason to this time. The first thing to notice is how SATA power and data cables get into the hard-drive tower. A tab at the bottom of the case can be released. But this tab covers the cable pass-through, where all your SATA cables must go. We positioned the WD drives on the bottom row to stay within our cables' reach.

Also note that if you want a clean case, the rest of the system's power must snake through a fairly small cutout, requiring long PSU cables. In our build, only the ATX cable was long enough to get where it needed to go. For the CPU power, we had to route through the floor grommet into the main compartment, back out the grommet under the mobo, and then back in through the grommet above the mobo.





1 This red LED-lit fan came with our power supply. While it uses a typical PWM fan connector, it also has a manual dial for fan speed and a switch to turn the lights on and off.

2 The 1,350W Maxrevo power supply gives us much more power than we need for this build. On the upside, it leaves more than enough headroom for overclocking and adding in more videocards.

3 The 2.5-inch drive cage in the PSU compartment sits right next to a fan, which helps keep SSDs (or 2.5-inch HDDs) cool.

4 The custom paint job by Smooth Creations really made this case a star. The retail case comes with tinted glass doors instead.

REENTRY AND SPLASHDOWN

AT $5,044, this lower-orbit version of the Dream Machine is still plenty pricey, but delivers dreamy performance at less than 25 percent of the cost of our DM's internal parts. This ship is essentially a tier above what we're able to achieve in our Turbo builds.

We had a lot of fun building into this case, which was a prototype that needed a refinement here or there. Even with minor shortcomings, the case presents well, has good airflow in all of the parts that matter, and even had room for our beefy Kraken X61, though it meant a little pushing and shoving to get everything to align. Many of the issues we had have been addressed and fixed in the production case.

When we ran our benchmarks, we really saw the kind of performance the GTX 980 Ti offers with its 6GB of VRAM. The fact that we used factory-overclocked models that we then overclocked some more paid dividends in the frame rate department.

The triple GTX 980 SLI setup in our zero point was outgunned by the higher VRAM the GTX 980 Ti's were packing. Given that a trio of reference GTX 980s cost $1,620 (at $540 each), the pair of GTX 980 Ti's, at $1,340 ($670 each), provides the greater value. Sometimes two really is greater than three.

That performance comes at the cost of power though: Reference GTX 980 Ti's draw 100 watts more than the plain-old 980 reference cards do. That's still less power than the 375 watts the Radeon Fury X draws, and two 980 Ti's will put you just 125 watts over the Fury X's power demand.

The i7-5930K served us well. A hearty overclocker, it got us to the same clock speed we had in the Dream Machine, but was just short two cores. Two cores are a big deal, but with such a huge price difference, the 5930K really delivers bang for your buck.

We could have saved a lot of coin on the hard drives, if that was a motivation, since the lower-capacity WD Black drives are far more affordable than their 6TB brethren. Likewise, builders pay a premium for a 1TB SSD. Opting for 250GB or 500GB models could save hundreds, which could go toward a third 980 Ti, a third SSD for a three-drive RAID array, or a bunch of games on Steam.

All in all, we're very happy with this build, and had a great time assembling this rocket. While still priced at a premium, we feel this mini–Dream Machine reaches for the stars, while remaining a little more attainable. ⏻

BENCHMARKS

	ZERO-POINT	
Stitch.Efx 2.0 (sec)	806	558
ProShow Producer 5.0 (sec)	1,472	1,163
x264 HD 5.0 (fps)	33.8	28.5 (-15.7%)
Batman: Arkham City 1440p (fps)	204	238
Tomb Raider 2160p (fps)	87.5	101.3
Shadow of Mordor 2160p (fps)	70.1	105.4
3DMark Fire Strike Ultra	8,016	8,378

0% 10% 20% 30% 40% 50% 60% 70% 80% 90% 100%

Our desktop zero-point PC uses a 5960X CPU, three GTX 980s, and 16GB of RAM. *Arkham City* tested at 2560x1440 Max settings with PhysX off. *Tomb Raider* at Ultimate settings. *Shadow of Mordor* at Max settings.

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TESTED. REVIEWED. VERDICTIZED.

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AMD
RADEON
P/N 804101000G01942

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AMD Radeon R9 Fury X

A new challenger looks to claim the heavyweight GPU title

AMD
RADEON
GRAPHICS
P/N 8041015000G(519A2)
RADEON
AMD

HBM requires far less board space, which makes the Fury X a very short card.

THE FURY X is AMD's first new halo product in over 18 months. Its last contender was the R9 290X (aka Hawaii), which did an admirable job against the competition. But as the months dragged on, Hawaii started showing signs of weakness. Nvidia's GTX 980 launched last October, connecting with punch after punch, all while fighting well above its weight class. The R9 290X needs 250W, while the 980 dances along at 165W. Now the Titan X and 980 Ti improve Nvidia's lead by another 30 percent. The 390X refresh doesn't help, increasing AMD's power draw to 275W just to keep pace with the 980. What AMD needed was a new contender.

And that's precisely what AMD has with the Fury X (aka Fiji). This is AMD's latest and greatest GPU, with 4GB HBM (High Bandwidth Memory) capable of an impressive 512GB/s of memory bandwidth. Add to that the 4,096 shaders, and AMD might be able to reclaim the title of world's fastest GPU. But there are some concerns.

The biggest problem is the memory capacity. HBM uses a silicon interposer to connect the GPU to the memory, but current tech limits Fury X to four 1GB HBM modules, or 4GB total graphics memory—less than the new R9 390/390X, as well as the GTX Titan/980 Ti. If you run games at settings and resolutions that exceed 4GB VRAM use, performance will suffer.

All the pre-match hype means nothing; the real decisions are made in the ring. Fury X is going up against the best of the best, supposedly with memory bandwidth and compute performance to spare. But we can't just look at theoretical performance and specifications; drivers and other elements come into play. This is why we play the games, fight the fights, and run the benchmarks.

We're running the same games as in our 980 Ti review, using the same 4.2GHz i7-5930K test bed, but we made a couple of tweaks. *Grand Theft Auto V* is an absolute beast to run at maximum settings, so this time we've disabled the Advanced features and turned off 4xAA when running at 4K (in which aliasing tends to not be as much of a problem). We've also disabled HairWorks in *The Witcher 3*.

THE FAST AND THE FURY X

AMD's Fury X trades blows with Nvidia's best. Of our eight test games, the Fury X wins two rounds and the 980 Ti/Titan X claim the remaining six. Some of the rounds are close affairs, others not so much. Ultimately, there's no question about the winner. The 980 Ti leads the Fury X by a scant 2 percent in our 4K testing, but that lead increases to 7 percent at 1440p and 13 percent at 1080p. However, in *GTA V* with Advanced Graphics enabled, the 980 Ti leads by around 25 percent, and in *The Witcher 3* with HairWorks enabled, the 980 Ti leads by 30–50 percent.

Performance parity isn't a bad thing, but there are other factors to consider. The Fury X doesn't overclock that well right now; we managed a mere 7 percent increase on the core clock and 10 percent on the HBM. Cooling isn't the problem, as the CLC is more than able to handle the heat, but the Fury X likely needs more voltage to reach higher overclocks—and we don't have the tools to boost voltages yet. As it stands, the Fury X can improve performance by about 7 percent with overclocking… but the 980 Ti is consistently getting 20 percent more performance from overclocking. For enthusiasts looking for every last bit of performance, it's no contest; throw in the additional memory on the 980 Ti and we have a TKO.

There's one question that remains: drivers. We can't help but feel there's plenty of room to improve the Fury X performance with driver updates. Currently, it's beating the R9 390X by 20 percent, but on paper the gap should be closer to 40 percent. Considering the newness of the Fiji architecture, not to mention HBM, it stands to reason that additional tuning will help. But if you want the fastest current GPU, the Titan X still holds that title, with the 980 Ti delivering 99 percent of the performance at two-thirds the price. **–JARRED WALTON**

VERDICT
8

AMD Radeon R9 Fury X

+ **MUHAMMED ALI** Good performance; quiet CLC; massive bandwidth.

− **LEON SPINKS** Costly; not enough memory; driver updates needed.

$649, www.amd.com

BENCHMARKS

	Fury X	Titan X	GTX 980 Ti	GTX 980	R9 390X	GTX 970
Batman: Arkham Origins	**114 / 57**	114 / 54	112 / 54	85 / 42	90 / 44	67 / 32
GTA V	49 / 46	**58 / 49**	**58 / 49**	46 / 39	44 / 36	38 / 33
Hitman: Absolution	**67 / 36**	64 / 33	64 / 33	50 / 25	60 / 32	40 / 19
Metro: Last Light	70 / 39	**81 / 44**	80 / 44	67 / 36	57 / 29	50 / 26
Shadow of Mordor	81 / 48	**85 / 48**	84 / 48	69 / 39	71 / 41	52 / 28
Tomb Raider	85 / 44	**92 / 47**	91 / 45	75 / 37	68 / 35	56 / 26
Unigine Heaven 4.0 compression (sec)	51 / 23	**63 / 27**	62 / 26	49 / 21	41 / 18	35 / 15
The Witcher 3	49 / 31	**54 / 33**	53 / 32	44 / 26	39 / 24	34 / 20
Eight Game Average	71 / 40	**76 / 42**	76 / 41	61 / 33	59 / 32	46 / 25

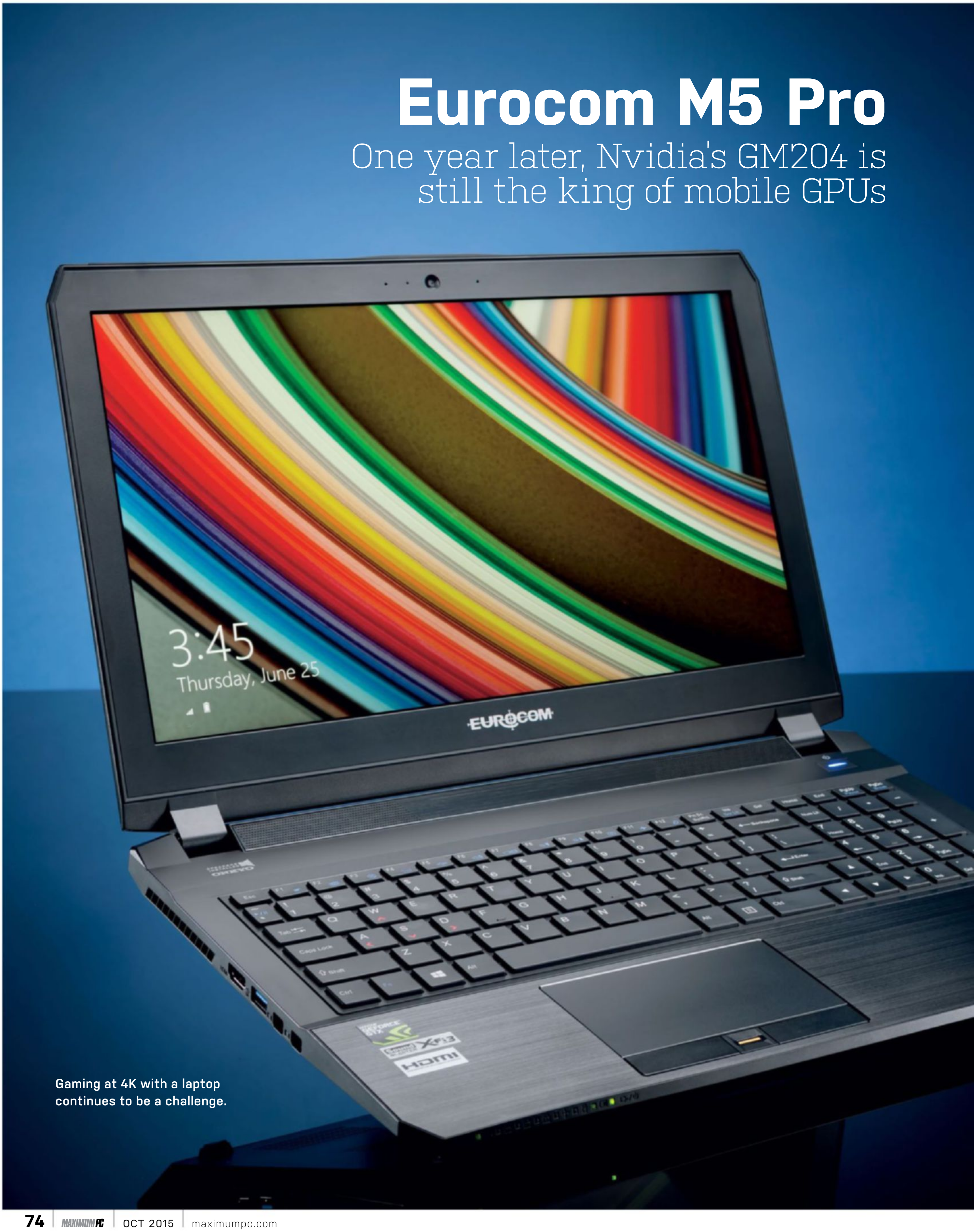
Best scores are bolded. Game results are average fps at 1440p/4K. Our test bed is a 4.2GHz overclocked Core i7-5930K in a Gigabyte GA-X99-UD4 motherboard, with 4x 4GB DDR4-2666 and an EVGA SuperNOVA 1,300W G2 PSU. The OS is 64-bit Windows 8.1. Graphics drivers are Nvidia 353.30 and AMD 15.7 Catalyst.

SPECIFICATIONS

GPU	Fiji
Lithography	28nm
Transistor Count	8.9 billion
CUs	64
Shaders	4,096
Texture Units	256
ROPs	64
Core Clock	1,050MHz
Memory Capacity	4,096MB
Memory Clock	500MHz
Bus	4096-bit
TDP	275W

Eurocom M5 Pro

One year later, Nvidia's GM204 is still the king of mobile GPUs



Gaming at 4K with a laptop continues to be a challenge.

LAST OCTOBER, Nvidia wowed the world with its potent new Maxwell 2.0 GPUs, and it pulled a doubleheader by launching the mobile variant right after the desktop parts. Since that time, if you wanted a top-performance gaming notebook, there has only been one question: Do you want GTX 980M, or will GTX 970M suffice? Eurocom's M5 Pro gives you the power to choose, though our review notebook goes the "more sensible, less extreme" route with a single 970M, and pairs it with a nice 4K Samsung PLS display for good measure.

That's going to be something of a challenge for the plucky GPU, as even the fastest desktop cards struggle with 4K gaming. On a gaming notebook, the only real option for 4K is to turn some of the settings down a notch... or two or three. And in some games, you're simply better off running at a lower resolution like 1080p.

Thankfully, the super-fine DPI of a 4K, 15.6-inch display means that running at non-native resolutions doesn't result in the blurriness you would normally experience. But DPI scaling in Windows does still have quirks on occasion, and ends up being two steps forward, one step back. So, 4K is perhaps future-proofing, but you're stuck paying $200 or more for what may or may not prove beneficial down the road, and many would find a 1080p IPS display to be a better choice.

Eurocom covers both bases. You can control exactly what upgrades you want and which ones you feel like skipping; your M5 Pro can be configured with parts customized to your liking. Eurocom has plenty of options for the CPU, storage, LCD, Wi-Fi module, and RAM (up to 32GB!). The M5 Pro also includes a fingerprint reader and TPM 2.0 module as standard, which is useful for business types. You can even select among three GPU options: GTX 965M, 970M, or 980M, though the 980M uses a slightly thicker chassis to accommodate the increased cooling requirements.

You don't buy a gaming laptop to run Office, and when it comes to gaming, the M5 Pro won't disappoint. Our zero-point Alienware 14 is left sucking dust in all of the gaming tests, with the M5 Pro delivering more than twice the graphics performance. At 1080p, the M5 can handle nearly maxed-out settings in most games, and Nvidia's GeForce Experience will happily provide any minor tweaks should those prove necessary. The only sore spot is going to be battery life, where the M5 Pro came in just shy of three hours of video playback, and moderate Internet surfing failed to last more than four hours.

BACK TO BASICS

Overall, the M5 Pro is a great gaming notebook, and the all-round experience remains good, even when we move on to other areas. The keyboard provides a pleasant typing experience, the touchpad eschews the clickpad trend in favor of two discrete buttons, and the speakers and display don't get in the way. In short, the M5 Pro is a well-built notebook. That may not sound much like high praise, but it's amazing how many laptops—even expensive offerings—manage to screw up one or more of those areas. Other than the mediocre battery life and the size of the notebook, the only potential concerns are pricing and the 980M.

The 970M is fast, but the 980M will be another 25–35 percent faster still. The price difference from Eurocom is $268, including the change in chassis, which means that spending 15 percent more for the upgrade is the way to go. You have to deal with a slightly larger notebook, but the M5 isn't small, no matter how you slice it, and for gaming, the 980M is the GPU to beat. If you can't afford to upgrade, however, the M5 Pro is still a potent gaming laptop. Note that other boutiques also use the Clevo P650SE/P650SG chassis, some with slightly lower prices than Eurocom, but most of them don't offer TPM support.

–JARRED WALTON

VERDICT
9
KICK ASS!

Eurocom M5 Pro

+ OUTDOOR CAMPING Fast; customizable; solid build quality; TPM support.

− FPS CAMPING Expensive; somewhat bulky; mediocre battery life.

$1,499, www.acer.com

SPECIFICATIONS

CPU	Intel Core i7-4710HQ
RAM	2x 8GB DDR3-1866 Corsair
GPU	GeForce GTX 970M 3GB
Display	15.6-inch, 3840x2160 Glossy PLS
Storage	256GB Plextor M6e SSD, 2TB Seagate 5,400RPM HDD
Connectivity	2x Mini-DP, HDMI, Ethernet, flash memory reader, 3x USB 3.0, USB 2.0/eSATA, Wi-Fi, Bluetooth 4.0
Dimensions	16.7 x 11.5 x 1 inches
Weight (Lap / Carry)	6.61 / 7.89lb

BENCHMARKS

	ZERO-POINT	
Stitch.Efx 2.0 (sec)	962	974 (-1.2%)
ProShow Producer 5 (sec)	1,629	1,572
x264 HD 5.0 2nd (fps)	13.5	13.85
BioShock Infinite (fps)	36.1	92.9
Metro: Last Light (fps)	30.4	85.3
3DMark 11 Performance (fps)	4,170	9,429
Battery Life (1080p video, mins)	234	167 (-28.6%)

0% 20% 40% 60% 80% 100% 120% 140% 160% 180% 200%

Our zero-point notebook is an Alienware 14 with a 2.4GHz Intel Core i7-4700MQ, 16GB DDR3-1600, 256GB mSATA SSD, 750GB 5,400rpm HDD, GeForce GTX 765M, and Windows 7 Home Premium 64-bit. *BioShock Infinite* tested at 1920x1080 at Ultra DX11 settings; *Metro: Last Light* tested at 1920x1080 at DX11 medium quality settings with PhysX disabled.

Future

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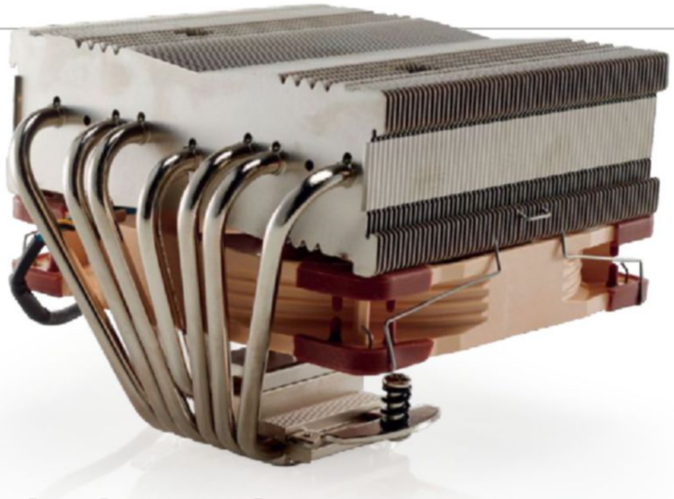


Noctua NH-C14S

Impressive design, but lacks cooling capacity

NOCTUA IS BEST known for its beige and brown fans, and has dominated the market for silent-operation, performance-heavy cooling options for as long as we can remember. It's a company with ideals pitched at those who don't care for the aesthetics of the components, more the properties they exhibit. Notably noise cancellation and a high degree of static pressure. As a result, it delivers some of the best performance that money can buy.

The Noctua NF-F12 is the prodigal fan you've probably heard about a lot. A 120mm static pressure-optimized, low-noise fan, managing an impressive 22.4dBA under load while pushing 82.5 cubic feet of air per minute with a static pressue of 20.4Pa. For those who don't know, static pressure is the force at which air is pushed back through the fan. The higher the pressure, the more beneficial it is for cooling dense radiators or CPU heatsinks. The lower the density of the fins on the radiator, or the heatsink, the less static pressure you need to push air through it, making CFM and airflow fans your new best friend.

This is all background info, time to get to the point. The cooler we have here is Noctua's latest NH-C14S. A low-profile CPU heatsink, which otherwise dwarves the small form factor builds we've tested it in. Powered by a 140mm Noctua AF14, this little fridge magnet pumps out an impressive 95W-worth of TDP on our Intel Core i7-4790K. The single 140mm fan stays quiet at around 24dB at load, and 19dB with the included low noise adapter. Although the heatsink is an impressive 142mm tall, we still managed to install a set of Corsair Dominator Platinums below the underside of the heatsink. The overall footprint of the NH-C14S is quite large, which is great for increased cooling capacity, but does give us pause, certainly in regard to the Asus Maximus Gene series with the raised PCB.

UNBOXING HEAVEN

What Noctua does do nicely is packaging. Unboxing this little beauty is a dream for anyone with any level of OCD. Opening the box, you're presented with three smaller packages, all different sizes. One for AMD, one for Intel and then an accessory box with Noctua's custom Allen key-esque screwdriver for mounting installation, nicely braided cables, and some premium thermal paste.

Installing the NH-C14S is a painless affair, which is especially impressive for an air cooler. You get a very solid backplate, with four plastic protectors and four extra threaded bolts to attach on top. Then it's a simple matter of inserting the specialized screwdriver down the two holes at the top of the heatsink and tightening the pre-attached, spring-loaded screws into the backplate. Job done. No fiddling around. You can even probably do this with the mobo inside the chassis.

Performance, meanwhile, was a little underwhelming. We tested with an Intel Core i7-4790K, which can run hot. But even at stock, we managed to hit the TJMax, running the standard blends test in Prime95, after just five minutes. With the core immediately throttling itself to compensate for the excess heat, overclocking just wasn't an option.

This cooler isn't as impressive as it should be. It's a little too big and lacks the cooling capacity of a full tower, or even a small AIO. Disappointing. What it does have is almost silent operation and impressive compatibility with memory modules. We're wondering if a more powerful fan would perform better to help improve the dissipation needed for the more powerful CPUs such as the i7-4790K. **–ZAK STOREY**

VERDICT

7

Noctua NH-C14S

+ **SERENE** Hyper-quiet; fantastic design; easy to install; packaging is great.

− **NIGHTMARE** Low TDP; not great at cooling the Core i7-4790K; large surface area.

$98, www.noctua.at

BENCHMARKS

	Noctua NH C14-S	Be Quiet Dark Rock Pro 3
Idle Temperature (°C)	**29**	30
Load Temperature Prime 95 (°C)	99	**57**
Load Temperature CineBench R15 (°C)	78	**62**
Idle (dB)	11	**9**
Load (dB)	23	**17**

Best scores are bolded. All tests were run using an Intel Core i7-4790K @ 4.0GHz (Turbo to 4.4GHz), ASRock Extreme 4 motherboard, 8GB DDR3 Dominator Platinum 2,133MHz, and an Nvidia Geforce GTX 980.

SPECIFICATIONS

Socket Support	AM3+, FM2+, 1150, 1155/56, 2011
Dimensions (W x H x D)	5.5 x 5.6 x 6.4 inches (with fan)
Fan Compatibility	1x 140mm
Weight	2.2lb (with fan)
Warranty	Six years

Gigabyte BRIX GB-BXA8-5557

This compact PC could make for a great HTPC

SMALL PCS have gone through quite a few revisions over the years. From the first standardized mATX solutions in 1997, we got proprietary cases and motherboard form factors (e.g., from Shuttle), then Mini-ITX went mainstream and did away with the proprietary stuff. Since then, the micro-computing market has exploded. From ultra-small PCs to compact but amazingly powerful systems like the Falcon Northwest Tiki (September issue, p.78), Mini-ITX solutions can fit just about any computing paradigm. But what if you want to go even smaller? We end up going full circle and returning to mostly proprietary designs, which is what Intel did when it launched the NUC (Next Unit of Computing) a couple of years ago.

Intel's NUCs obviously use Intel processors, but other manufacturers are free to expand on the idea, and that's precisely what Gigabyte has done with its BRIX line. The model we're looking at dumps the Intel Ultrabook components and instead uses AMD alternatives, in this case a 35W A8-5557M APU with HD 8550G graphics. Last year, Gigabyte had a beefier version of this Brix with an R7-M275X GPU alongside the APU. Many complained about the noise from the system fans, so Gigabyte came back with this trimmed-down variant, complete with a lower price.

SIX OF ONE...

Considering Intel's Ultrabook parts have a lower TDP, not to mention the fact AMD makes better GPUs than Intel, what you get is the usual compromise of a slower CPU with faster graphics, for a lower price. Intel's Core i5-5250U Broadwell CPU posted better numbers in Stitch.Efx, Proshow, and 3DMark, and Intel's NUC uses less than half as much power. But for games, the A8-5557M was better. Just.

The fact is, neither of these integrated solutions are very fast. They work better as streaming solutions. And not just for games. Whether it's online movies, YouTube videos, or files served from your local NAS, micro-PCs such as the Brix make for great HTPCs, though we do have to note that the A8-5557M processor wasn't powerful enough to handle 4K H.265 videos (1080p H.265 worked OK).

For those with modest computing needs, the A8-5557M is fast enough, and outside of gaming, the discrete GPU isn't really necessary. The small system fans are noisier than we'd like (41dB from 12 inches), but at least under load they don't get much louder (43dB). This Brix isn't intended to be a powerhouse, but it can be a decent SOHO device.

It has two SO-DIMM slots for up to 16GB RAM, built-in 802.11ac Wi-Fi, and support for both mSATA and 2.5-inch SATA drives. Getting the system up and running is as simple as adding your own memory and storage, and then installing your OS. We used a 16GB kit of G.Skill DDR3-1866 memory, which the Brix only ran at 1,600MHz, and for storage we used a 1TB Samsung 850 Pro—overkill, probably, but it worked well.

Ultimately, this Brix is a niche device, but it can go places where even Mini-ITX is "too big," and it's cheaper than the NUCs. It's too bad the fans aren't quieter, though, especially for HTPC use. –JARRED WALTON

BENCHMARKS

	Brix GA-BXA8-5557	Intel NUC5i5RYK
Stitch.Efx 2.0 (sec)	2,626	**1,594**
Proshow Producer 5.0 (sec)	2,986	**2,391**
3DMark Cloud Gate	4,050	**5,466**
3DMark Ice Storm	42,492	**52,185**
GRID: Autosport (1080p Med)	**30.1**	20.6
Idle Power (W)	20	**4**
1080p H.264 Power (W)	35	**14**
Prime95+Furmark Power (W)	60	**28**

Best scores are bolded.

VERDICT 7

Gigabyte BRIX GB-BXA8-5557

+ **LEGO** Tiny; dual storage; reasonably priced.

− **CINDER BLOCK** Fans a bit noisy; middling performance; not as efficient as NUC.

$240, www.gigabyte.com

SPECIFICATIONS

CPU	AMD A8-5557M
Graphics	Radeon HD 8550G
IO/Connectivity	HDMI, mini-DP, 4x USB 3.0, Gb Ethernet, 802.11ac WiFi, Bluetooth 4.0, headphone
Storage	mSATA, 2.5-inch SSD/HDD

QNAP TVS-871 NAS

QNAP
TVS-871
169.254.100.100

The NAS that does it all

IF YOU'RE SERIOUS about storage, you're probably going to consider some type of NAS (network attached storage) system for your home. And if you're serious about a NAS, there are a few companies you should consider. And of the ones you should consider, there are fewer still that have the right chemistry of performance and features rolled into one unit.

Enter the TVS-871, a beast of a NAS. This unit has everything except the kitchen sink thrown into it. It comes in several flavors, and can be configured with drool-worthy features, such as 10Gb Ethernet, and up to an Intel Core i7-4790S processor. Our unit came preconfigured with the following make-a-standard-PC-jealous specs: Intel Core i7-4790S quad-core CPU; 16GB of RAM; four 1Gb Ethernet ports (upgradeable to 10 GigE); RAID 0, 1, 5, 6, 10; multiple USB expansion ports; and HDMI output supporting 4K.

We configured our unit with eight Red NAS 4TB drives (WD40EFRX) from Western Digital, but you can configure it with whatever you wish. The TVS-871 supports SSD caching for increased outbound/read performance by installing an SSD in one of the bays, but we opted to fill all eight bays with HDDs.

Upon login and the obligatory admin setup, we immediately configured the TVS-871 to RAID 6. The system recommended RAID 6 by default, but you're able to choose whatever RAID level you desire. On a NAS like this, there's really no point in using RAID 0, since performance won't be realized over 1Gb Ethernet, and you'll want some sort of redundancy. At our 32TB of total system capacity, RAID 1 would get you 16TB and allow up to four drive failures before complete catastrophe, but halving our total capacity seemed wasteful.

We went with RAID 6 because you get the best combination of performance, redundancy, and capacity. RAID 6 is essentially like RAID 5, but with support for double drive failures. With RAID 6 configured, we were left with a total usable capacity of 24TB.

The TVS-871 isn't your average storage-only NAS, though. QNAP has integrated a wealth of kick-ass features, including: virtualization, Plex media server, web server, VPN server, MySQL server, TFTP server, torrent downloader, and much more. You're able to download apps from the QNAP app center, and run CMS, gallery, and forum back-ends. As a matter of fact, you're also able to use the TVS-871 as a full desktop PC running QTS Linux.

SOMETHING FOR EVERYONE

QNAP pitches the TVS-871 as a very capable media-delivery box. The unit comes equipped to serve out your movies utilizing KODI (aka XBMC), but you're more than welcome to go with Plex. We set Plex's transcoder to "make my CPU hurt" for maximum quality. With the Core i7-4970S's QuickSync hardware transcoding, streaming media to our tablets and phones was a breeze, taking up just a hair of the unit's ample processing power.

We tested several features of the TVS-871, including RAID fail, rebuild, and throughput. Unfortunately, the unit we have did not have its 10 GigE card installed, so we weren't able to test its full throughput potential, but it lets you see performance on typical gigabit networks.

There's a lot to be said about the QNAP TVS-871, far more than can be written in this review alone. The TVS-871 has something for everyone, and in excess. Depending on your needs, it can be a straight-up storage unit, or it can be much more. Those who are into some serious home-theater setups will appreciate what QNAP has done. All the fancy features aside though, having an obscene amount of terabytes at your disposal is drool-worthy by itself anytime. That said, at $2,199, you're looking at a serious chunk of change for all that awesome. **–TUAN NGUYEN**

VERDICT
9
KICK ASS

QNAP TVS-871 NAS

NASTASTIC Ultra fast; plenty of storage configurations; true utility server; eight drive bays.

NASTY Pricey; not well documented; no RAID 60 support.

$2,199, www.qnap.com

BENCHMARKS

File Copy Write	117.6MB/s
File Copy Read	117.2MB/s
File Copy Write RAID 5	117.8MB/s
File Copy Read RAID 5	116.6MB/s
File Copy Write RAID 6	115.1MB/s
File Copy Read RAID 6	116.4MB/s
File Copy Write RAID 10	117.0MB/s
File Copy Read RAID 10	115.0MB/s
Single Drive 1TB Active Rebuild (hh:mm:ss)	01:24:38
Single Drive 1TB Non-Active Rebuild (hh:mm:ss)	01:07:03

Samsung 850 Pro 2TB

Large *and* agile? Samsung takes a brave step forward for the future of SSDs

SAMSUNG
Solid State Drive

The 850 Pro is perhaps the best SATA drive yet. But it's still a SATA drive.

PERFORMANCE OR CAPACITY. That's been the dichotomy that's dominated data storage since the first mainstream solid-state drives appeared nearly a decade ago. But now Samsung has launched the first 2TB SSDs aimed at consumers. Give it up for the Samsung 850 Pro, tested here, and its 850 Evo sibling. At last, the speed of solid-state flash has been combined with the multi-terabyte mass storage that's previously been the preserve of conventional hard drives and their spinning magnetic platters.

How has Samsung done it? It's largely down to its 3D V-NAND memory, the trailblazing flash memory tech that sees memory cells stacked atop one another, rather than arranged in a flat, 2D array. The obvious benefit is the ability to squeeze much more capacity into a given area. But the upsides go further. Using multiple layers of memory cells, for example, takes the pressure off the need for each layer to absolutely maximize capacity.

That means mature rather than cutting-edge silicon production processes can be used, increasing yields and reducing costs. It also means the chips aren't on the ragged edge of performance, making them more reliable, often a major limitation for flash memory that wears out gradually as data is written to the memory cells. In practice, that means that where Samsung's previous-gen 840 series drives sported NAND memory with tiny 19nm transistors, the 850 series gets by with 40nm tech.

To achieve the headline-grabbing 2TB capacity, Samsung hasn't had to weave too much magic on the memory front, but it has had to come up with a new controller chip. Samsung says its existing MEX controller—as seen in the existing 128GB to 1TB 850 Pro SSDs—had limitations when it comes to really high capacities. Consequently, the new 2TB has a new controller, the MHX.

Samsung's performance claims suggest the increased capacity doesn't incur any performance downsides. It quotes exactly the same numbers for the new 2TB 850 Pro as existing Pros down to 250GB. So, that's 550MB/s sequential reads, 520MB/s sequential writes, plus 100,000 read IOPS and 90,000 write IOPS.

STAYING POWER

Where things get really interesting is durability. The 2TB absolutely does not disappoint. Samsung provides a mega 10-year warranty, along with expectations of 300TB-worth of writes. Wow. That's probably even more important with a really large drive than a small SSD, which you might expect to replace within a couple of years. This thing has legs.

However, the elephant in the room is that the 2TB model, and indeed all Samsung 850 Pro and Evo models, don't offer compatibility with the latest storage interfaces. We speak of PCI Express-based interfaces like M.2 and SATA Express. The 850 Pro 2TB is a plain, old SATA drive.

That means it's limited to a real-world peak performance of 550MB/s. That's simply a function of the 6Gb/s limitation of the SATA interface. What's more, SATA uses a control protocol known as AHCI, which was conceived for magnetic hard drives, not SSDs. That, in turn, makes SATA suboptimal in terms of random access performance with SSDs.

If you're upgrading an existing system—and particularly a laptop—that shouldn't be a problem. You may not have any M.2 slots in your PC, anyway. But as the storage solution for a new PC you're building, or for an existing system with M.2 support, the limitations of SATA are more of a problem. Compared with the near-2GB/s of bandwidth being kicked out by M.2 drives, the 550MB/s top whack of a SATA drive makes even this 2TB drive look outdated.

Samsung's figures are born out in testing as well. In terms of raw sequential throughput, it'll do 559MB/s for reads and 534MB/s for writes. In other words, it's simply bouncing off the limitations of the SATA interface. As for random access performance, we're talking 41MB/s for reads and 133MB/s for writes, which are again as good as it gets for a SATA drive.

Arguably, more interesting is the fact the 850 Pro 2TB clocks in with probably the fastest time we've seen for a SATA drive in our real-world 5GB file compression test. It's only a matter of a second or two, but it's further confirmation that this drive is about as good as it gets for SATA technology.

For context, the latest M.2 drives are up near 2GB/s for sequential reads and 200MB/s for 4K random writes. So, how you view this drive's performance ultimately comes down to whether you're in the market for an M.2 or a SATA drive. It's great for a SATA drive, but it can't really get close to a drive built around the latest standards. That's a tough pill to swallow when being asked for $800.

Viewed in the broad context of all SSDs, the new Samsung 850 Pro 2TB is dead slow. The latest M.2 drives absolutely annihilate it for raw performance. However, narrow the context down to SATA drives and it suddenly finds itself at the very top of the pack. So, it really comes down to your buying needs and preferences. If you need the biggest and best SATA SSD for something like a laptop upgrade, this new Sammy is a killer.

–JEREMY LAIRD

VERDICT
7

Samsung 850 Pro 2TB

+ SUPER BOWL Serious storage; stellar endurance; great for laptops; fast for SATA.

− NAIA CHAMPIONSHIP Really expensive; limited by SATA interface.

$800, www.samsung.com

BENCHMARKS

	Samsung 850 Pro 2TB	Samsung 850 Pro 512GB	Intel SSD 750 1.2TB NVMe
ATTO read (MB/s)	559	561	**2,671**
ATTO write (MB/s)	534	532	**1,322**
AS SSD read (MB/s)	524	528	**2,136**
AS SSD write (MB/s)	497	500	**1,175**
AS SSD 4K read (MB/s)	**41**	37	38
AS SSD 4K write (MB/s)	133	107	**200**
5GB file compression (sec)	**69**	73	**69**

Best scores are bolded. Tested with an Intel Core i7-4790K on an ASRock Z97 Extreme4 motherboard, with 8GB of Corsair Dominator DDR3 at 1,600MHz.

SPECIFICATIONS

Capacity	2TB
Memory Type	3D VNAND
Controller	Samsung MHX
Interface	SATA 6Gb/s
Form Factor	2.5-inch
Warranty	10 years limited

Gigabyte P34W V3

Has Gigabyte really found the "no compromise" ultra-thin gaming laptop?

ONE OF THE HOLY GRAILS for a gaming laptop manufacturer is the powerful, ultra-slim gaming machine. That's the focus from Gigabyte on its P34W v3, and it gets oh-so-close to pulling it off. The 14-inch gaming laptop hasn't been a form factor we've regularly seen. Maybe it's due to a lack of efficient hardware, which might explain why we're starting to see more small gaming machines—both the main CPU and GPU manufacturers are now really focusing on power efficiency for their performance hardware.

This slimline laptop then is rocking a Haswell Core i7-4720HQ, running at 3.47GHz at max turbo clocks, with four cores and eight threads. Supporting that processing power is Nvidia's GTX 970M, a hefty upgrade from the P34 v2's GTX 860M. That Maxwell GPU packs 3GB of dedicated GDDR5 memory and a maximum 924MHz GPU clock speed. Realistically, of course, in a chassis this size, you're not going to hit those heights—the P34W v3 maxes out at 540MHz. There's always a compromise.

But still, that CPU/GPU combo delivers impressive raw gaming performance, especially when compared with some of the other GTX 970M-powered machines we've tested, such as the Aorus X3 Plus v3 (July issue, page 82), which costs around $500 more than this Gigabyte.

The storage of this review version is split between a 128GB Liteon mSATA drive and a 1TB HDD. There's enough space on the SSD for the OS and your favorite game—that's probably your lot, when games like *GTA V* are pushing 60GB installs.

CALM DOWN

It's good to see Gigabyte not getting over-excited about screen resolution, too. The P34W v3 isn't sporting some stupid, tiny 4K panel. Or even a QHD one. This is straight 1080p territory, and that's to the Gigabyte machine's advantage.

The lower screen res means you get great gaming performance at the laptop's native resolution. But that's not to say this is a weak screen, being "only" HD. This is a quality IPS panel with wide viewing angles and crisp colors. Our first reaction was that the surrounding bezel was too thick, but the display is so arresting once it's turned on that we never noticed the bezel again.

Unusually, for a gaming laptop, we're really impressed by the trackpad. It's quick, wide, and responsive, with no discernable lag. And Gigabyte has opted for a discrete button. There's no style-over-substance integrated solution with the trackpad surface for the left and right buttons.

There are compromises, though. The biggest with small form factor gaming laptops is in the cooling. It's not just that the components get so hot in such a small case—the CPU hit an alarming 97°C and the GPU 87°C—but the fans end up working incredibly hard just to keep things going. That means the P34W v3 is a very, very loud laptop when you're doing, well, anything. As soon as we did something vaguely taxing with either CPU or GPU (which share the same heatpipes and twin fan array), it transformed into a leaf blower.

There's no discrete gaming for you here then, but with a pair of decent headphones, it'll only be everyone else in the building who'll be bothered. **–DAVE JAMES**

VERDICT 8

Gigabyte P34W v3

⊞ **LAPTOP** Ultrabook aesthetics; lovely IPS screen; high-end CPU/GPU combo.

⊟ **LEAF BLOWER** Very loud; very hot.

$1,584, www.gigabyte.com

SPECIFICATIONS

Screen Size	14-inch IPS
Native Res	1920x1080
CPU	Intel Core i7-4720HQ
Memory	8GB DDR3 single channel
GPU	Nvidia GTX 970M
Storage	128GB Liteon mSATA SSD, 1TB WD HDD
Weight	5.8lb

BENCHMARKS

	Gigabyte P34W v3	Aorus X3 Plus v3	Asus G751JY
Cinebench (index)	618	654	**674**
Heaven 4.0 (min/avg fps)	8 / 41	5 / 15	**27 / 56**
Shadow of Mordor (min/avg fps)	31 / 48	21 / 28	**34 / 69**
Bioshock Infinite (min/avg fps)	18 / 73	8 / 73	**15 / 95**
Metro: Last Light (min/avg fps)	17 / 33	9 / 13	**23 / 42**

Best scores are bolded. All benchmarks run at the laptop's native resolution and max settings.

The 14-inch form factor is almost perfect for the gaming-on-the-go machine… if it wasn't for the noisy cooling.

Asus MG279Q

Behold, the messiah of monitors

CONSIDER THE KEY METRICS. We're talking 27-inch, 2,560 by 1,440 pixels, 144Hz, and adaptive syncing. Oh, and here's the real kicker. We're also talking IPS. Cue much rejoicing. The new Asus MG279Q ticks an awful lot of boxes. It's not a super-wide panel with 3,000-plus horizontal pixels. Nor is it a 4K box. But 2,560 by 1,440 pixels is arguably where the sweet spot is right now in terms of matching pixel grids with GPU power—4K panels are marginal for smooth rendering on a single GPU.

Intriguingly, you get all this for less money than Asus's familiar ROG Swift monitor. That panel is very similar in many regards. It's 27 inches, has 2560x1440 pixels cranked out at 144Hz, and also sports adaptive sync. But it also differs in two critical regards. The ROG Swift's adapative sync is the Nvidia-flavored G-Sync technology and its LCD is a TN item. This screen, meanwhile, sports AMD's competing FreeSync tech and packs an IPS panel. Game on for fratricidal fun?

Yes and no. For starters, it's absolutely no contest when it comes to image quality. This new IPS model whips the Swift raw with the spiky end of a DVI cable. It's an absolutely gorgeous screen. The colors are as good as we've seen pretty much anywhere on any screen. It's just the most glorious combination of accuracy and saturation, at the same time as seeming perfectly natural and not remotely forced, the latter being a routine issue with VA panels, which often look punchy but thoroughly OTT.

GHOST STORIES

Where things get complicated, both in terms of the comparison with the Swift and in terms of actual technical implementation, is when it comes to adaptive sync tech. Adaptive sync means aligning the refresh rate with the output of your graphics card for improved smoothness and an end to screen tearing. We've known for a while that AMD's FreeSync technology is a little rough around the edges, and unfortunately, that remains the case here. For starters, FreeSync doesn't currently play nicely with response-enhancing overdrive tech. Long story short, you get some nasty inverse ghosting with FreeSync enabled.

The MG279Q actually does a good job of getting to grips with the problem, thanks to a wide choice of adjustments for the overdrive setting, which is accessed via Asus's excellent OSD. Set it to minimum and there's little-to-no ghosting, but a fair bit of blur. Crank it up to max and the ghosting is utterly grim. At around 40 percent the blurring is fine and it doesn't add any noticeable ghosting either.

Next up, the FreeSync in this implementation is also limited to a maximum refresh rate of 90Hz. That's enough to get much of the smoothness benefit of high refresh rates, but not all of it. Of course, you could argue that once you're up over 100Hz, the benefits of adaptive sync are marginal. So, if your graphics card is up to it, running with FreeSync disabled and the panel set to full 144Hz reheat could be the answer.

Casting a shadow over all of this is the fact that you'll need an AMD GPU to run FreeSync, while G-Sync screens like the Swift need Nvidia graphics. Given that monitors are generally pretty long-term purchases, that makes for a potential GPU vendor lock-in that leaves us a little uncomfortable. Not that this is Asus's fault. But it's certainly worth bearing in mind.

That said, you're not really paying extra for the FreeSync capability. So view the Asus MG279Q as mainly a 144Hz IPS panel and it's still a very appealing proposition. Is it the best gaming monitor yet? Very possibly. **–JEREMY LAIRD**

VERDICT
9
KICK ASS!

Asus MG279Q

⊞ **MESSIAH** Fast; customizable; solid build quality.

⊟ **VERY NAUGHTY BOY** Not exactly cheap; FreeSync doesn't play nicely with overdrive; not as spectacular as a super-side of 4K screen.

$600, www.asus.com

SPECIFICATIONS

Panel Size	27-inch
Native Resolution	2560x1440
Panel Technology	IPS
Max Refresh Rates	144Hz
Adaptive Sync	AMD FreeSync
Inputs	HDMI, DisplayPort
Stand	Tilt, rotate, height, swivel
VESA	100x100mm

Karog of Hel
Rincewind
ASUS

Asus's latest screen combines 1440p, 144Hz, and adaptive sync. Nice.

Fractal Design Define S

Does Sir require liquid cooling support? This case has it in spades

WE KNOW WHAT you're thinking. Yet *another* Fractal Design Define mid-tower case looking just like all the others. Well, before you doze off, the Define S has a few tricks up its sleeve, not least of which is a price tag a few bucks less than its predecessor, the Define R5.

While it may look very similar to the R5, one difference is immediately apparent: The Define S has a solid front bezel instead of a door. The reason is simple, there are no 5.25-inch drive bays. In these days of digital content, the good old optical drive is needed less and less, meaning it makes sense to get rid of the bays to save space.

From the outside, the Define S may look like all its siblings, but on the inside, it's a completely different ball game. More than ever before, Fractal has designed the internal layout with liquid cooling support in mind. For a start, there are no conventional drive cages. We instead get three drive trays housed on the rear of the backplate. Each tray supports either 3.5-inch or 2.5-inch drives, while there's also two more dedicated 2.5-inch trays to the rear of the motherboard tray. It's very neat, but you can't help thinking there isn't going to be much in the way of cooling going on for the drives.

Where the drive cages would normally be found, there's a big, empty space. At least until you look closer. The backplate has been drilled for mounting a liquid-cooling reservoir (mounts are included) and the base can support many different types and sizes of pump units. There's no real excuse not to have a very tidy setup.

As for radiators, it comes as no surprise that the Define S can support the odd one or four. There's room at the front for a rad of up to 360mm, regardless of thickness, while you can get anything up to 420mm long (with a thickness limit of 55mm for the longer lengths) in the roof. Plus, the back panel can house either 120 or 140mm units. There's room in the base for a 120mm rad, but bear in mind if you go for this option that there's a 165mm limit for the length of the PSU.

The case also features Fractal's ModuVent covers on the top panel. All of the covers can be removed to allow fans to be fitted. As an aside, the $75 non-windowed version has a fourth vent in the side panel as well.

SO WHY SO CHEAP?

As they say, the devil is in the detail. It's only when you take a closer look that you begin to understand why the Define S comes with a low price tag. For starters, there are only two USB 3.0 ports in the I/O bay—the R5's bonus pair of USB 2.0 ports have gone. Also gone is any form of integrated fan controller, plus the side panels are back to being the notched variety, not the previous latched version.

A really nice design touch is the small hole at the bottom of the mobo backplate, close to where the audio header on a motherboard is situated. It means that this is one case where you don't have to drape the front audio cable across the front of the board—it just runs neatly behind the backplate, along with all the other cabling.

Fortunately, despite the price tag, the Fractal Design attention to detail and superb build quality remain as high as ever, even down to the simple things like cable management. **–SIMON CRISP**

VERDICT 9

Fractal Design Define S (Windowed Version)

+ **WELL-DEFINED** Superb build quality; liquid cooling support; price; good cable management.

− **FUZZY** No fan controller; not much air flow for drives.

$85, www.fractal-design.com

SPECIFICATIONS

Form Factor	ATX, mATX, Mini-ITX mid tower
Dimensions (W x H x D)	9.2 x 17.8 x 20.5 inches
Weight	18.7lb
Cooling	*Front* 3x 120/140mm (1x 140mm included); *Rear* 1x 120/140mm (1x 140mm included); *Top* 3x 120/140mm; *Bottom* 1x 120/140mm
CPU Cooler Max Height	180mm
Graphics Card Max Length	450mm
Storage Support	3x 3.5/2.5-inch, 2x 2.5-inch dedicated

Razer Mamba Tournament Edition

Setting a new bar for sensitivity

NOT THAT LONG AGO, customization was all the rage in the mouse world. Back when the first Cyborg R.A.T. scurried across our desks, we thought that every mouse from that point on would be customizable for the subtle nuances of our sweaty palms. And indeed, since its first release, there have been numerous R.A.T.s and copycats released, suggesting there is indeed a market for rodents that can be perfectly tailored to your hands. However, as the latest Razer Mamba proves, there's more to customization than shape and size.

Physically, this new Mamba Tournament Edition isn't too different from the original Mamba, albeit with a slightly less flared design around the main two buttons. There is one important difference with the Mamba TE though—it's wired. There's another version of the Mamba due that favors wire-free gaming, but here, a 7-foot USB cable does the hard work. Clearly, pro-gamers don't want to run out of juice at that vital moment, and it's something we can empathize with, having had to search for fresh batteries in the heat of battle.

There are a couple of headline-grabbing features with the Razer Mamba TE, not least of which is the Philips laser sensor, boasting precision up to a stunning 16,000dpi. This would be impressive on its own, but you also have total control over this precision; in 1dpi increments no less. It's going to take a while to nail down, but somewhere between 100–16,000dpi you'll find the perfect setting for you. Or that should be settings, plural, as you can configure from three to five different precision levels and flick between them using the two buttons that sit behind the mouse wheel. The Synapse software enables you to change the polling rate as well—to either 125, 500, or 1,000 times a second—as well as configuring separate X and Y sensitivities.

There are a total of 11 buttons that can be assigned to various actions using Razer's Synapse software. The mouse wheel is home to five of these buttons, as it rocks left and right as well as scrolling up and down. Don't forget that you can click the mouse wheel as well. The two buttons above the thumb are large and easy to bounce off when gaming without having to shift your thumb unduly.

LIGHT TOUCH

The Mamba TE's most controversial "feature" is its lighting: It sports RGB illumination on the left and right sides of the main body, on the Razer logo that's generally hidden under your palm, and on the scroll wheel. You can independently set any of these to the color of your choice, set up animated waves, or have the mouse flash when you click a button. It's pretty, but little more than a distraction.

This all leaves one rather important question. What's it actually like to use? The answer is subjective, but to us, the Mamba TE is an impressive gaming mouse. When we first picked it up, we found it a little lighter than we usually prefer (and there's no way of adding bulk), but we soon got used to it. It's smooth and precise in game—whether you're playing an MMO, FPS, or RTS, there's enough here to get excited about. We found it comfortable after long gaming sessions, too, though it does favor a claw grip for marathon sessions.

Which is all very glowing, apart from one small point. The price. There are so many great mice available that you've really got to do something special to warrant dropping so much on a relatively simple rodent. We're not sold on the lighting, and it clearly adds to the cost, but the dream of finding your perfect precision does make up for it. Yes, $150 is a lot for a mouse, but the latest Mamba TE is at least worth considering. **–ALAN DEXTER**

VERDICT
8

Razer Mamba TE

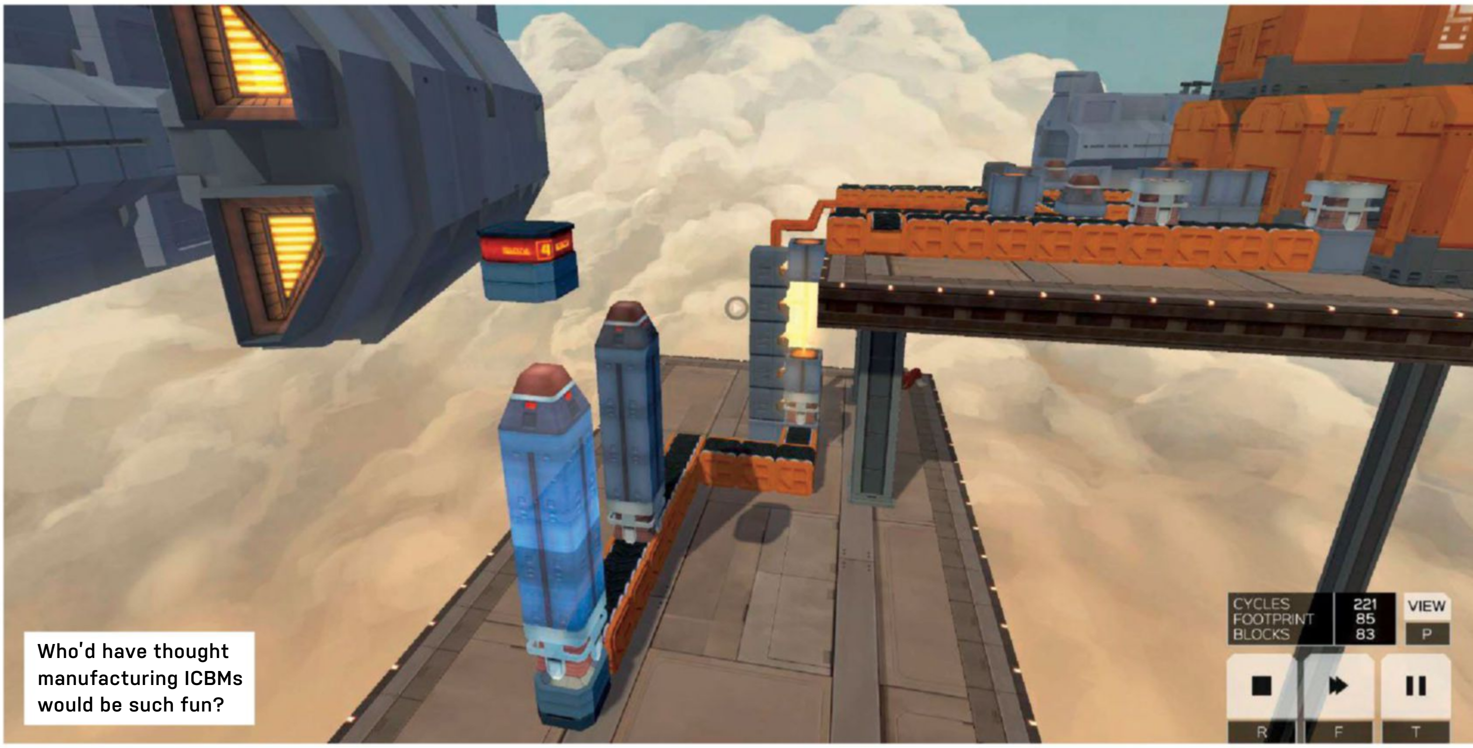
➕ **SHOWCASE** Impressive laser sensor; great customization options; strong software; comfortable.

➖ **BASKET CASE** Expensive; lighting is little more than a distraction.

$150, www.razerzone.com

SPECIFICATIONS

Sensor	Laser
Max Sensitivity	16,000dpi
Programmable Buttons	9
Cord Length	7ft
Weight	0.3lb



Who'd have thought manufacturing ICBMs would be such fun?

Infinifactory

The smartest game in the solar system just went 3D

HERE'S A FASCINATING historical "might've-been" for you. The man who made *Infinifactory*—Zachtronics, aka Zach Barth—almost made *Minecraft*. After all, Notch's game was an admitted copy of *Infiniminer*, one of Zachtronics's early games. But *Infiniminer*'s source code was leaked shortly after launch and the game was abandoned, allowing Notch to swoop in and make a (much-improved) copy, then sell it five years later for $2.5 billion.

Barth hasn't seemed unduly upset by these events, but has continued to put out the super-puzzle games he's become known for. The most famous of these is *SpaceChem*, a superb chemistry/programming game that's available free to schools. *Infinifactory* is an indirect sequel.

In *Infinifactory*, you play an anonymous pleb, abducted by aliens and forced to build machinery. You see, the aliens are either too lazy or too thumb-fingered to build anything themselves, but they have this whole armada that needs constant crafting and maintaining. They, apparently, do this by kidnapping humans and getting them to do it (the ones who pass the initial tests, anyway). Your rewards for performing all of their tasks range from a selection of random trophies to VHS tapes with no video player, and from a pile of food pellets to a bare cell in their mothership.

There is no escape. Attempts to use the supplied jetpack to fly away have you swiftly returned to your work station. The only successful way out, it appears, is death, and scattered across the levels are the bodies of previous workers, complete with the recordings of their last moments.

This is all a very *Hitchhiker's Guide to the Galaxy* justification for doing some puzzles, but it gives the game some design coherency and vim. Hunting out the audio diaries of your failed predecessors, for example, is one of the game's side-joys.

PROCESS POWER

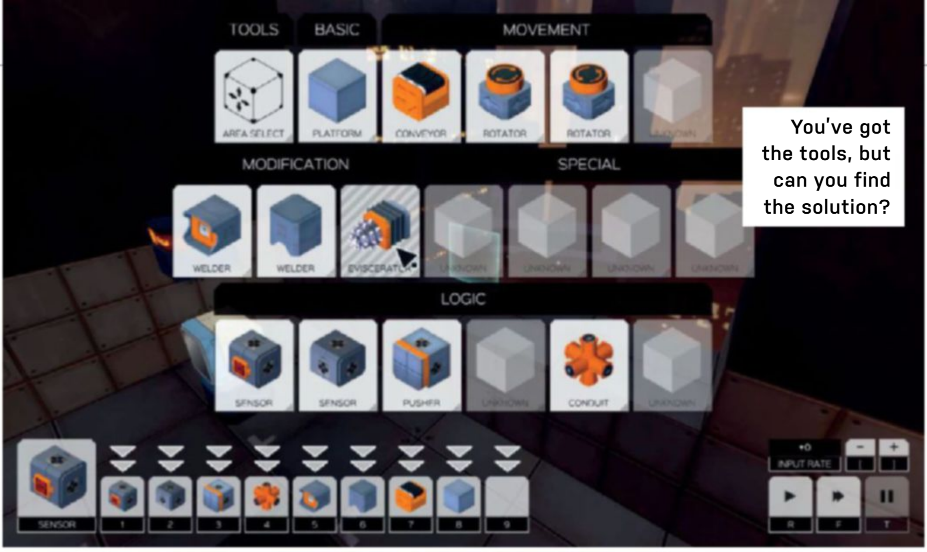
The puzzles themselves are doozies. Each level gives you certain inputs and asks you to use them to generate certain outputs. The inputs are produced by machines at certain locations and often need substantial processing—rotating, welding, separating, destroying—and good timing to be in the right order, at the right place, for the right process. The processing is the core part of the puzzle, as you place down blocks that affect blocks passing over them, or detect blocks in the case of sensors, triggering actions elsewhere.

Unlike *SpaceChem*, these puzzles are three-dimensional, which means a solved puzzle can be completely obscure. All you can see from the outside might be inputs and outputs passing through a gray cube, while the complex products of your reasoning are buzzing away inside. It also means that gravity has to be taken into account, so your structures can't just float in the air.

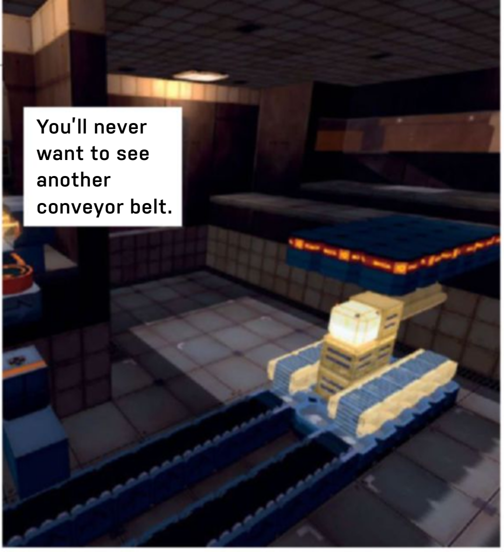
When you're ready—or you just want to test your system—you can trigger the machines to start outputting, and watch your system succeed or fail. A useful fast-forward function helps you get to the critical point (which can sometimes be after a few minutes of processing), while a pause lets you scrutinize the moment.

It's worth saying that some of the usability elements that made *SpaceChem* slightly more accessible are missing here. Rewind and slow-mo functions, like in *SpaceChem*, would have been useful, as they're helpful for understanding where you're going wrong. The ability to copy and replicate groups of blocks you use regularly is also missing.

Other game's puzzles are obscure, or feature elements of randomness—a standard Match-3, like *Candy Crush*, gives you arbitrary new objects, while the puzzle element's impact on your targets is minimized, so that your choice is to play the odds many times or buy your way through to the next level. By comparison, what's unique about all of Zachtronics's games is

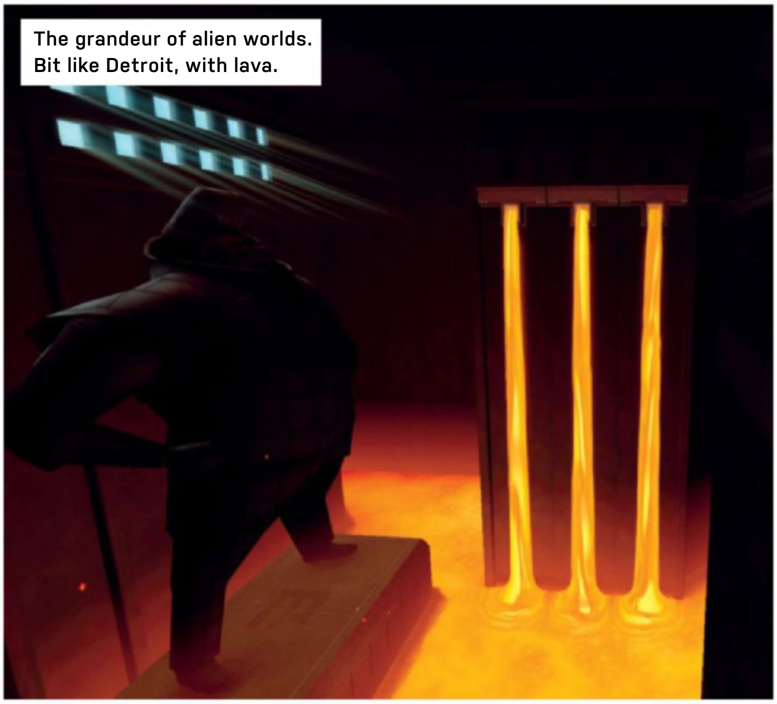


You've got the tools, but can you find the solution?

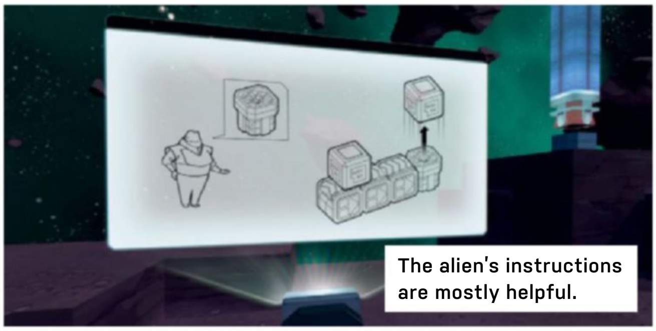


You'll never want to see another conveyor belt.

Our (bored) alien overlords.



The grandeur of alien worlds. Bit like Detroit, with lava.



The alien's instructions are mostly helpful.

that they're pure tests of reasoning. Nothing is hidden and everything is known—the inputs, the techniques, the outputs, and the level layout. It's entirely down to your imagination and logic whether you can solve the puzzle or not. And given those sandbox tools, there's no single solution.

NOT SO SIMPLE

That makes it hard. These puzzles look simple—move and combine these blocks—but they're often unbelievably difficult, and require endless iteration. It's one of those games that you'll dream about, and wake up in the morning with a possible solution to a difficult level.

Significantly, like *SpaceChem*, at the end of each puzzle area you get to see how you've done relative to your Steam friends, and compared to the world averages, on three different measures—the number of cycles your apparatus took, the amount of blocks it needed, and the amount of floorspace it needed. It's a great touch, because it immediately hints at the other possible routes you could have taken, or to congratulate yourself on beating the average. There's no victory so hollow as completing a level inefficiently using 40 blocks, then seeing a friend completed it using just four blocks. Nor victory so sweet as doing it using just three.

Once you've completed the game's main storyline and campaigns, you can start trying puzzles that users have made on Steam Workshop.

It's worth noting that if your computer can't run *Infinifactory*, or you're simply a hardcore, old-school programmer, then you might want to consider *TIS-100*, another game that Zachtronics has released at the same time on Steam Early Access. It's functionally the same game as *SpaceChem*, but the fancy graphical user interface has been replaced by programming code and a screen style that will be familiar to older DOS or BASIC users.

Infinifactory, like its predecessors, is the perfect mixture of gentle humor, soft-touch storytelling and rigorous puzzle-solving. At its heart is that loving, logical minimalism that's necessary for engineering or philosophy. As such, it's a game we'd heartily recommend for children from seven to 70. **–DANIEL GRILIOPOULOS**

VERDICT 9

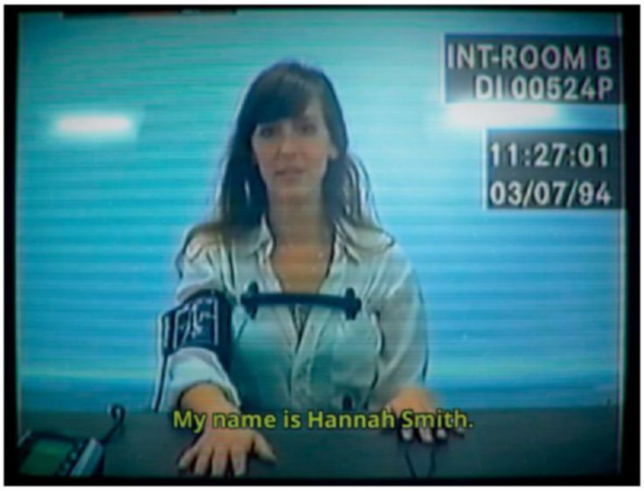
Infinifactory

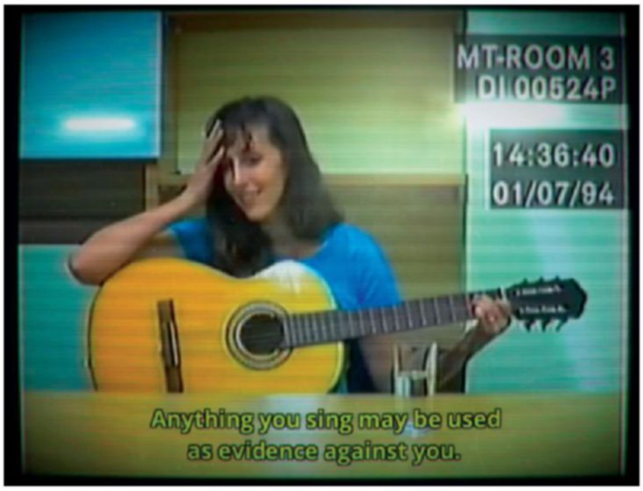
AD INFINITUM Gentle storytelling and humor; tough puzzles; Steam integration.

AD NAUSEAM Can be quite inaccessible.

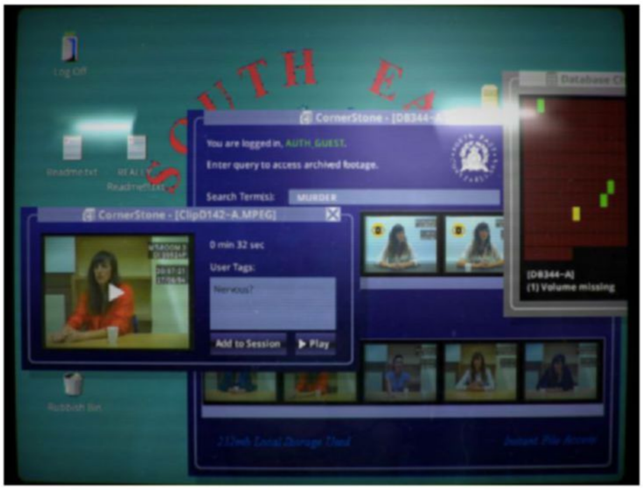
RECOMMENDED SPECS 2GHz CPU, 2GB RAM.

$25, www.zachtronics.com, ESRB: T





The actress, Viva Seifert, is also a singer, which is shoehorned nicely into the game.



Her Story

An unreliable narrator reveals a reliable whodunnit

MOVIE GAMES have a bad name among older gamers. The disasters of the past—such as the infamous *Plumbers Don't Wear Ties*—gave the false impression of choice, with horrible linear narratives, low-res video, and cheap production values. *Her Story* is an entirely different sort of "video" game. It's one that fixes some tools of those older games, while bending others into weapons for its intriguing, unreliable narrative.

Notably, the game doesn't improve on the style of those old games. Indeed, it has a deliberately archaic look because of its premise. You're someone looking through the police video archives for details of a murder that took place in 1994. All of the clips feature interviews with one woman: Hannah, the victim's wife. The system you're using is so ancient, damaged, and badly organized that the only way to see the too-short clips is by searching. And the engine only returns the first five results.

What could've been a linear TV drama, where the viewer sits back and has revelations drip-fed, turns into a puzzle game. You enter keywords, watch a video, and learn more keywords, understanding more of the story as you go. The crafting of your experience, so that the first interviews you see shape your expectations, means your theories are confounded over and over. Search for "murder," and you'll find almost nothing. Search for "dreadful," and you get an excellent impromptu guitar session. Search for "Hannah," and you'll get just the first five clips, and not the later, more revealing videos. It's superbly smart.

MURDER MYSTERY

The game is bolstered substantially by its single acting talent, Viva Seifert. She's the only person who appears on screen and, though her acting style is definitely classical, it's highly effective, especially given the deliberately primitive medium. Her elegant, minimal expressiveness is convincing, especially when mingled with the grotty screen overlay, clacking keyboard, and primitive OS you're using.

You face some questions immediately. Where did her husband go? Was she involved? How can a plot be compelling with just one, unreliable character? The rabbit holes you're taken down as you search, however, fill in all of the characters and events of her world, in a believably dull fashion, and throw out moments of charm and unease equally well.

As a game, however, it doesn't entirely work. Attempting to scrape together the last 25-50 percent of the video clips, once you think you've figured out the plot, is quite difficult. A design decision in the PC version has the result that you may never figure out how to end the game. Once you do formally "end" it, the developer gives you two cheat codes, which should help you find every last clip. The fact the developer has to do that shows the limits of the structure.

Her Story is a unique experiment. Part one-woman theater, part search engine, part murder mystery, and a small part game, it enthralls for much of the experience. Play it quickly, play it slowly, but do play it. Then tell us whodunnit.

–DANIEL GRILIOPOULOS

VERDICT 8

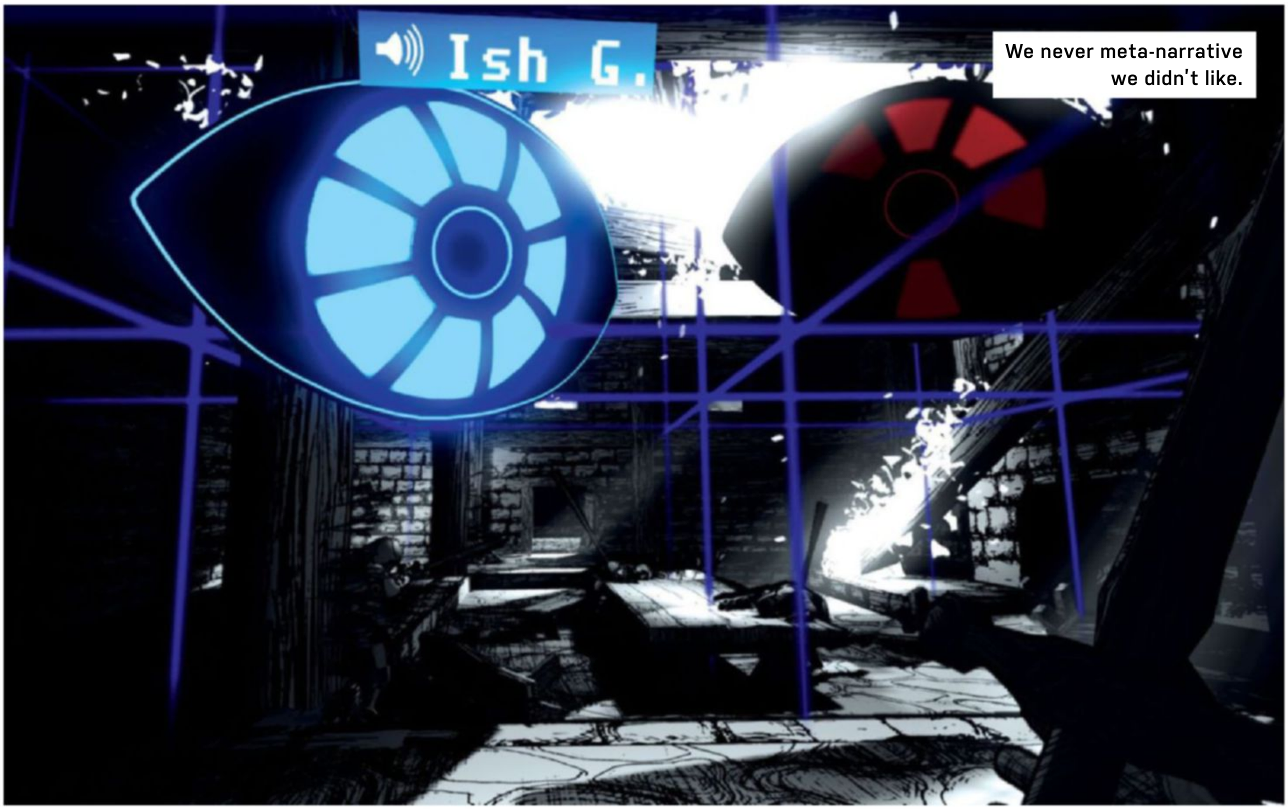
Her Story

+ DETECTIVE Intriguing story; great actress; smart use of a dead genre.

– DUNCE Doesn't work brilliantly as a game.

RECOMMENDED SPECS 4GB RAM, 1GB graphics card.

$6, www.herstorygame.com, ESRB: NR



We never meta-narrative we didn't like.

The Magic Circle

A self-aware game within a game

THERE HAVE BEEN plenty of films set inside the movie industry, such as *The Player* or *Barton Fink*. There have been plenty of songs about the music industry, like Pink Floyd's "Have a Cigar" or The Sex Pistols' "EMI." But games is a field that's mostly escaped the satirical art of navel-gazing, save for isolated incidents such as *Game Dev Tycoon*. *The Magic Circle* sets out to change that.

You play as a tester, wandering an unfinished game that's been delayed since time immemorial due to the ego of its legendary designer, Ishmael "Starfather" Gilder, a diva who hasn't released a title since text adventures were the peak of tech. But a public demo needs to be ready for the big E4 conference, so Starfather can satisfy his fans and release something, anything.

With that backstory in mind, much of the game is placeholder, from the landscapes to the commentaries, and from the art style to the setting. Your task, set by Pro (a disgruntled protagonist left over from an abandoned science-fiction prototype), is to finish the game. But Starfather seems determined to make it as terrible as possible and put off the release for as long as possible, while his fangirl intern Coda and blackmailed pro-gamer Maze both have their own agendas. All three appear in the world, as they debug and change it around you.

PLAYING GOD

You play the game from a first-person perspective. Early on, you're given the power to trap enemies and edit them—that is, go into their code and alter their default behaviors—whether they fly or run, attack with melee or a railgun, regard you as a friend or foe. Even whether they're fireproof or share a group mind, or can teleport or open force fields, or... well, you get the idea.

It's a great mechanic, and turns the game into a kind of action strategy, as you explore the small world, using your growing pack of bizarrely edited monsters to defeat other creatures and acquire their abilities, and bypass puzzles. The world itself has a variety of attractive art styles, from monochrome sword-and-sorcery to the abandoned science-fiction version to dungeon-editor. There are collectibles, if that's your kind of thing. There's a section where you redesign the game, and watch an AI play it for you. It's all tongue-in-cheek and hugely self-referential, if a little trite.

Despite that, the game feels like it was intended to be more ambitious than it is, as if it suffered cuts itself. The explorable world is small, the number of puzzles limited. A full run-through took us just seven hours, and there was little we felt the need to return for. Despite that, the well-written satire, the customizability, and the knowingness make it an enjoyable ride.

Games don't do humor well. Perhaps only the LucasArts adventures and *Time Gentlemen, Please* have been laugh-out loud funny in recent years. *TMC* is smarter than it's witty, but it's a knowing, acerbic, and fun look at the big egos and failures in game development.

–DANIEL GRILIOPOULOS

VERDICT **7**

The Magic Circle

+ GANDALF Extremely knowing; unique enemy-editing mechanic; attractive art style.

− SARUMAN Quite small game world.

RECOMMENDED SPECS AMD X2 5200+/Intel Core 2 Duo E6420; 4GB RAM; Nvidia 8800GT/Radeon HD4830.

$20, www.magiccirclegame.com, ESRB: NR

LAB NOTES

JIMMY THANG **ONLINE MANAGING EDITOR**

The Nightmare Machine?

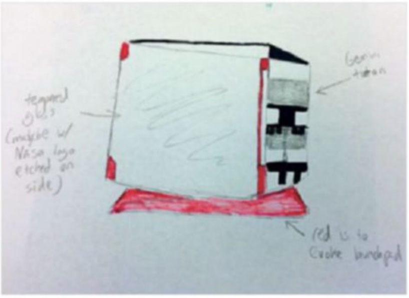
The frustrating side of Dream Machine that you don't see

HERE'S SOMETHING you may not know about the Dream Machine: Getting it done is always a nightmare. Don't get me wrong, every year the project seems like a fun science assignment. Being able to brainstorm what we'd like to put into the build makes me feel like a kid in a candy store. Coming up with an engaging theme that's both exciting to work on (and, we hope, for you to read) really gets my creative juices flowing. But actually executing on the build can be a logistical horror show.

In order for Dream Machine to be ready in time for newsstands, we have to plan, communicate, and get components in very early, so that we have ample time to build and benchmark. This often means we have to deal with prerelease hardware or beta drivers that haven't been properly stress-tested, at least not in the crazy configurations that we put them through. And for Dream Machine, it feels like a bit of Murphy's Law is always at play. That is to say: What can go wrong, will go wrong.

It's almost a Dream Machine ritual that we'll experience accidental leakages with our custom water loop, and this year was no different. On top of that, the initial case that we wanted to use proved to be too small for the cooling solution that we wanted to install. We also weren't sure if four Titan Xs would play well with Dell's 5K monitor, which, with its ridiculous resolution, is meant more for the professional editing scene than it is for the gaming crowd. Would the drivers play well with it? Hell, would our PSU be able to withstand the load of our system's overclocks?

It's quite fitting that we went with a NASA theme for this year's build, because every year it feels a little like we're ground control and we're trying to shoot our system safely into orbit. A lot of creativity and ingenuity, and a little bit of elbow grease went into this build, but I'd like to think that in the end, we more than accomplished our mission.


tempered glass (Could be w/ Nasa logo etched on side)
red is to

Here's an early concept sketch I did of this year's Dream Machine.

ALEX CAMPBELL

Associate Editor

This was the first time I had the privilege of helping to build a Dream Machine. I knew it was a big project to undertake, but this year's was the biggest and baddest single machine yet. Things didn't always go exactly to plan, but then, that's always going to be the case with any big build.

It reminded me, however, of why we love to build: for the pure fun of it! I often compare working on PCs to working on cars. It's an easy comparison, with similar premiums put on high performance.

But after building this year's Dream Machine, I think I understand the lives of project car builders even more. We might not get quite as messy, but the passion is just the same.

JARRED WALTON

Senior Editor

Sometimes, things don't go as planned. Case in point, *Batman: Arkham Knight*. I've been a big fan of the *Arkham* series since the first game, and I was looking forward to this latest installment. In an unprecedented move, however, the PC release had so many problems that Warner Bros. pulled the game from Steam and retail sales.

A few quick thoughts: First, there is no way Warner Bros. didn't "understand the issues." It just didn't care.

Second, the default 30 frames per second cap was idiotic and totally out of touch with the PC world.

Third, I'm still having a good time playing the game, and it runs fine on higher-end GPUs. Call me a beta tester.

First Look: Oculus Touch

Going hands-on with Oculus's VR input

UP UNTIL RECENTLY, finding good controls for VR was like looking for a pixelated needle in a digital haystack. Oculus VR has finally tossed its official solution into the mix with Oculus Touch. With it, you get two controllers that are somewhat akin to Wii's Nunchuck controller, but the Touch has a few key enhancements.

Each controller is roughly the same size as a Nunchuck and has buttons for your index and middle fingers, but the Touch also has two face buttons on top, near the joystick. What really distinguishes it from Nintendo's solution, though, is that it offers 1:1 controls, meaning your hand movements are pretty much exactly like your real hand movements in real life. It also has a little ring along the outside of your knuckles, which allows the controller to track the position of your thumb and index finger. This means you'll be able to give thumbs-up gestures, and be able to point at objects for the benefit of your online VR buddies.

At this year's E3, there was only one Oculus Touch demo—built internally by Oculus and dubbed "Toy Box"—but oh, man, what a demo it was! It's a co-op sandbox experience and our co-op buddy turned out to be none other than Oculus VR founder Palmer Luckey. He was in a separate room down the hall, but we were able to communicate using the HMD's built-in mic.

What ensued was a roughly 20-minute experience that took us into another dimension. The demo takes place in a quirky sci-fi, playful laboratory environment. As we put on the headset, we could see two floating hands, and a generic bald blue head staring at us from about four feet away, representing Luckey. He looked directly at us in this virtual environment and walked us through how to use the controller.

"Pick up the controller and use your index finger to point at something," he said. We did so, and it worked great. "Give me the thumbs-up signal," he said, and that worked swimmingly, too. "Clench down on the controller and make a fist for me," he said, and as expected, our two virtual hands made fists. While we love Valve's similar VR controllers, these simple finger gestures add an unprecedented level of immersion. Yes, given what we know so far, we do think it's better than Valve's already-stellar VR controllers.

Throughout the rest of the demo, we picked up and shot guns, played catch with each other, fired slingshots, and more. This is a demo that will stick with us forever, an unforgettable experience that offered an unparalleled level of presence that we hadn't felt before. It also helped that Luckey was obviously bent on providing us a great experience. It felt oddly intimate at times, as if we might have to apologize for bumping into him if our virtual bodies got too close.

We've never felt more confident in the future of VR than we do now, and we're excited about how the medium will grow moving forward. The only really pressing question on our minds now is: When can we have these new toys, damn it? **–JT**

Oculus Touch is like Wii Nunchucks on steroids.

GEEK TESTED & NOT APPROVED

Razer Firefly

FOR PEOPLE who put their mice directly on the top of their desks, a mouse pad might seem a little unnecessary. After all, modern mice are optical, and don't pick up all the gunk that mechanical ball mice used to.

After playing with the Razer Firefly, we did notice a difference in response. Games had better movement and a nicer feel to mouse control. Then we looked at the price tag: $60. For a mouse pad. Granted, it's a mouse pad with LEDs in it. But at the end of the day, it's a piece of plastic that sits under your mouse. It's really hard to recommend a device—and it is a USB device—that just sits there and costs $60. For comparison, SteelSeries and Logitech offer mouse pads for $10 and $15, respectively.

Besides the price tag, the Firefly rubs us the wrong way because it needs (and automatically installs) Razer's Synapse software when you plug it in. If you're not running other Razer hardware, it's easy to get kind of pissed about this.

On the other hand, if you're already invested in the Chroma line of Razer peripherals, this pad looks really nice with your setup. We tested it with a BlackWidow Chroma and DeathAdder Chroma, and the pad does look handsome when colors are coordinated through the Synapse software. As it stands now, only a couple of color modes (like static and spectrum cycling) are supported. And it will make your desktop look like it's straight out of a sci-fi flick.

Unless you're looking to go Razer all the way (or you're addicted to shiny LEDs), pass this up and get a cheaper mouse pad. If you really must have LEDs on everything or really need every Razer peripheral, have at it. **–AC**

$60, www.razerzone.com

LETTERS

WE TACKLE TOUGH READER QUESTIONS ON...

> Laptop CPU Choices
> Malware Removal
> Case Issues

Santa Has Questions

I'll be purchasing a new Dell laptop for (wife's) Christmas. It will most likely be a 14-inch Latitude E7000 series. It will run Windows 10 Pro and Office 2013. Our IT department supports all Dell products, we have special pricing as well as a dedicated sales rep. That being said, I enjoyed the August article "Intel vs. AMD Chip Wars" that covered desktops. (I'm running the AMD FX-8350 on my home desktop.) I prefer a dedicated GPU versus integrated graphics with all my computers.

My question is, which CPU should I choose for her custom-build laptop? Dell's options are usually limited to "fourth-gen i5 or i7, fifth-gen i5 or i7." Rather than defaulting to the fifth-gen i7, what configuration would you recommend? General specs will be: dedicated GPU, 8GB RAM, SSD, HD and (?) CPU. **—Larry Waters**

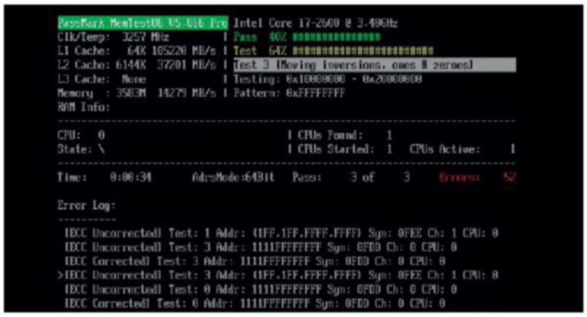
ONLINE MANAGING EDITOR JIMMY THANG RESPONDS: Hey, Larry. Being that we're *Maximum PC* and not Minimum PC, we almost always default to high-end i7 variants, but it really depends on what you're looking for. If you're looking for a laptop that's mostly used for web browsing and video viewing, a Core i5 with 8GB of RAM will do fine. Hell, an i3 with 8GB would be more than enough. If you're looking to do some gaming or video editing, however, you'll want the i7. It becomes less of a bottleneck for your GPU in certain games and in video encoding tasks, so it basically pays for itself over time. If all you're using it for is Netflix, Microsoft Office, and photo editing, however, save the cashola and go for the Core i5 unit.

[NOW ONLINE]

THE ULTIMATE HARDWARE TROUBLESHOOTING GUIDE

As much as we love computers, sometimes they're annoying and don't work as well as they should. "Why won't it just work?!" is something you've probably exclaimed at least once or twice in your life.

Well, the good news is that it's often your fault... or at least, stay with us here, most PC issues are something you can fix. Yes, it's true that a million things could go wrong with your PC, but we've rounded up some of the biggest and most common offenders (blue screen errors, boot issues, driver crashes, etc.) and have outlined how to solve them in our hardware troubleshooting guide online. http://bit.ly/1f5g4MB



```
PassMark MemTest86 V5.0ib Pro Intel Core i7-2600 @ 3.40GHz
Clk/Temp:  3257 MHz          | Pass  40% ################
L1 Cache:   64K 105220 MB/s | Test  64% ##########################
L2 Cache: 6144K  37201 MB/s | Test 3 [Moving inversions, ones & zeroes]
L3 Cache:  None              | Testing: 0x10000000 - 0x20000000
Memory  : 3583M  14279 MB/s | Pattern: 0xFFFFFFFF
RAM Info:
---------------------------------------------------------------------
CPU:   0                            | CPUs Found:    1
State: \                            | CPUs Started:  1   CPUs Active:    1
---------------------------------------------------------------------
Time:    0:00:34      AdrsMode:64Bit   Pass:     3 of     3    Errors:    52

Error Log:
----------
 [ECC Uncorrected] Test: 1 Addr: (1FF.1FF.FFFF.FFFF) Syn: 0FEE Ch: 1 CPU: 0
 [ECC Uncorrected] Test: 3 Addr: 1111FFFFFFFF Syn: 0FDD Ch: 0 CPU: 0
 [ECC Corrected] Test: 3 Addr: 1111FFFFFFFF Syn: 0FDD Ch: 0 CPU: 0
>[ECC Uncorrected] Test: 3 Addr: (1FF.1FF.FFFF.FFFF) Syn: 0FEE Ch: 1 CPU: 0
 [ECC Uncorrected] Test: 0 Addr: 1111FFFFFFFF Syn: 0FDD Ch: 0 CPU: 0
 [ECC Corrected] Test: 0 Addr: 1111FFFFFFFF Syn: 0FDD Ch: 0 CPU: 0
```

Memtest86 running tests on RAM.

Buried in Malware

I think the days of buying a PC with an OS pre-installed are coming to an end. Almost six years ago I bought a laptop with Windows 7. I was prepared, thanks to you, for all the bloatware. Namely, I used PC Decrapifier.

Recently, I purchased a refurbished laptop from a popular auction website, which also had Windows 7 pre-installed. The new bloat/malware is remarkably difficult to remove! SuperAntiSpyware would only run for a few seconds. Windows Defender was disabled. Norton Power Eraser didn't find anything. Control Panel's Uninstall was... full. I would select a program to be removed; a handful of license agreements would appear. CCleaner would try to delete programs, but it was no match. And PC Decrapifier was in over its head. My next computer is going to have an unformatted hard drive(s.) And the OS is going to be in disk form. And a completely separate transaction.

—Ray Pearson

↘ submit your questions to: comments@maximumpc.com

SENIOR EDITOR JARRED WALTON RESPONDS: Hi, Ray. While bloatware is a hassle to remove, it sounds like you got more than you bargained for. We've reviewed many laptops, and very few couldn't be cleaned up with a bit of TLC and some time spent uninstalling software.

The symptoms you describe sound like the laptop was infected with some serious malware, perhaps even a rootkit. A clean install of Windows is often the best way to ensure you don't have a bunch of other junk floating around, but it isn't usually required, as the OEMs have a vested interest in not pissing off their customers.

Of course, in the case of a refurbished laptop, especially from an auction site, all bets are off. A clean install is highly recommended. I'm assuming you already did that, but if you still need ideas, I'd add Malwarebyte's Anti-Malware (http://bit.ly/1blh2vG) to your list of important utilities. The free version is better than most commercial packages at clearing out malware, but it can still miss a few items that may require manual intervention (as in editing the registry).

Two other free utilities that can help are Junkware Removal Tool (http://bit.ly/1ddP2vZ) and also AdwCleaner (http://bit.ly/1HU87BH), but if you've got a new system that you haven't invested any time yet in getting set up, wiping it clean tends to be far less work than hunting down rogue malware.

Case Closed

I have a similar build to the budget one you built for the retired sergeant ("Build It," August issue), and I'd just like to add one thing. I have the same Enermax case. It was a great deal when I got it and I love it.

However, the ATX plug that you mentioned being flimsy I think is more of the case's fault. I have a Biostar TA970 board with an FX6300 in there and I had a similar problem with the board flexing. When I finally replaced my Thermaltake power supply, I couldn't get my ATX power out, and when I installed the new one, I bent the board beyond what I'm comfortable with just getting it in. So, while I think the case is great, I think you should let people know it is the case's fault and not the Gigabyte board's.

—Ryan Franzese

ASSOCIATE EDITOR ALEX CAMPBELL RESPONDS: Hi, Ryan. You're right, the fact there isn't a standoff hole for the mount point next to the ATX power connector points to a flaw in the case design, more than the mobo.

The case is a budget case, however, and a budget item of any kind is going to result in some sort of compromise. Careful building (like placing a finger under that mount point when attaching the ATX power) can reduce that flexing stress. Of course, if your ATX power cable is long enough, you could attach it to the mobo before you mount it in the case.

One of my guiding principles in building is "don't force it." I've sweat plenty of bullets when things didn't lock as easily as they should. I find it's often best to back up, do a sanity check, and try again. The Enermax case was chosen for its price, easiness to find, and the fact it was easy to build into, despite the issues. The compromise on the case left room for other things in the budget, and cases are rarely the most expensive part in a system (unless you just really loooove high-end cases). That means the case itself can be an upgrade opportunity when the builder has a spare $100.

The Big Build-Up

While I appreciate all the fine info regarding building different systems, it would be nice to have an article that offered specs that one could use to put together various pieces of the system—such as: Use this motherboard and you can plug in these parts, various CPUs like which i3, i5, or i7 would work, then which RAM types, which graphics cards, etc. Ideally, starting with a basic, medium, max motherboard then adding the pieces. **—Michael**

EDITOR-IN-CHIEF TUAN NGUYEN RESPONDS: Hi, Michael. In a perfect world (with unlimited print space), we'd love to do something like this. But there are so many different combinations of products coupled with an ocean of mobo variations. It would be a near-impossible task. However, we have been going in that direction. If you look on our website, under the "Best of the Best" section, you can find details on our top picks for motherboards, from low- to high-end. And the same holds true for other components—except RAM, which we'll get to soon. If you're looking for something along the lines of a system configurator, I suggest www.pcpartpicker.com. They're our very good friends!

Facebook Polls

Living The Dream

Every year, we build Dream Machine around a motif. If you were to build a Dream Machine, what would your theme be?

Bryan Leo Jensen: Winter is coming.

Christian Geohagan: Blackout. Absolutely blacked out and as quiet as possible.

Chris McNeil: TARDIS theme. Micro form factor in the outside, giant tower on the inside.

Jesse Niou: Jon Bon Jovi's "Slippery When Wet."

Ross Myers: A sleeper; totally enclosed beige or black box, no detectable sound at all, and blazing fast.

Max Hall: Industrial. Stainless steel and Lexan case, stainless steel water-cooling tubing, possibly red battle lighting.

Joel Funaki Gonzalez: My Little Pony. Seriously.

Taylor Riley: Zen, waterfalls, and bamboo. I'm still trying to figure this out for me.

Erik Korsgard: I was really into that oil-submersed PC you built. Something like that.

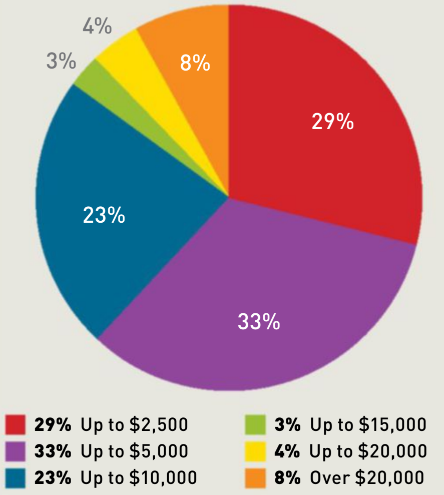
Tom Edwards: Air Force Wings.

Ryan Hoffman: Highest performance with lowest power draw. Efficiency is where the real skill comes in.

Richard Hernandez: Steampunk theme, including all the peripherals.

Adam Saint: I'm really not fussed about how it looks as long as it performs superbly in the things I do with a computer, like 4K gaming.

How much would you spend on a Dream Machine?



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THE BUILDS

BUDGET GAMER

INGREDIENTS

PART			PRICE
Case	Rosewill Neutron	**NEW**	$40
PSU	Corsair CX500M 500W		$60
Mobo	ASRock Z97E-ITX/ac	**NEW**	$130
CPU	Intel Core i3-4150		$115
GPU	EVGA 3962-KR GeForce GTX 960 SC	**NEW**	$225
RAM	2x 4GB G.Skill Ripjaws (red) DDR3/1600		$55
SSD	240GB SanDisk Ultra II		$105
HDD	Seagate Barracuda 1TB		$51
OS	Ubuntu Desktop Linux 14.04 LTS 64-bit		$16

Approximate Price: $797

RECENT PRICE DROPS on the Core i3 and switching to EVGA's shorty GTX 960 gave us a little breathing room this month. We used the cash to upgrade the mobo, which offers M.2 support and SATA ports that are parallel and at the edge of the PCB, allowing for longer GPUs. Going with the Rosewill Mini-ITX case saved us $10 and gave us a form factor that will be better suited to gaming in the living room. The i3 isn't that powerful, but should allow you to run many games at playable frame rates. This machine can also be used as a beefy Steam streamer or HTPC. The roomy Rosewill has a drive cage that will take up to four hard drives. It also has space for an optical drive.

MIDRANGE

INGREDIENTS

PART			PRICE
Case	Corsair Vengeance C70		$118
PSU	EVGA SuperNOVA G2 850W		$137
Mobo	Asus Z97-A/USB 3.1		$149
CPU	Intel Core i5-4690K		$240
Cooler	Corsair H100i		$104
GPU	XFX Radeon R9 390	**NEW**	$330
RAM	2x 4GB Crucial Ballistix Sport DDR3/1600		$50
Optical Drive	Samsung SH-224DB/BEBE		$20
SSD	2x Mushkin Enhanced ECO2 120GB		$106
HDD	Western Digital Black Series 2TB	**NEW**	$123
OS	Windows 8.1 64-bit OEM		$100

Approximate Price: $1,477

WE'VE FINALLY made the switch to the Radeon 300 series. Although it uses the same chipset as the 200 series, the increased clock speeds and doubled VRAM do matter in real-world gameplay. Prices for the R9 290 are running in the $270 to $300 range, so spending the extra $30–$60 for the memory isn't that big of a jump. We also dumped the 3TB Seagate Barracuda for a 2TB WD Black. The WD drive is backed by a five-year warranty, which gives us a little more peace of mind. We were tempted to go with an M.2 SSD, but high-speed M.2 storage is still too pricey for us to justify dumping the RAIDed SSDs. For the same price, you can put three (or sometimes four) SSDs in RAID 0.

TURBO

INGREDIENTS

PART			PRICE
Case	Corsair Graphite 780T		$190
PSU	EVGA SuperNOVA G2 850W		$137
Mobo	MSI Gaming 9 ACK X99	**NEW**	$420
CPU	Intel Core i7-5820K		$390
Cooler	Cooler Master Nepton 280L		$120
GPU	MSI GeForce GTX 980 Ti 6GB	**NEW**	$660
RAM	4x 4GB Corsair Vengeance LPX DDR4/2133	**NEW**	$140
Optical Drive	LG Blu-ray Burner WH16NS40		$59
SSD	2x 500GB Samsung 850 EVO		$378
HDD	3TB Western Digital Black		$155
OS	Windows 8.1 64-bit OEM		$100

Approximate Price: $2,749

WE WERE ABLE TO SAVE MONEY by picking another reference model GTX 980 Ti this month. We went with MSI's model for the price point, but there's room in our budget if a factory-overclocked or enhanced-cooling model is desired. Falling prices for the 850 EVO gave us breathing space to splurge on the MSI mobo. The board has support for M.2, allowing for more storage options. We stuck with the EVOs for their capacity, but if speed is what you need, you can get a fast (2,150MB/s sequential-read fast) M.2 SSD for $368. We dropped our RAM speed from 2,400 to 2,133, and there's a reason: Most boards run RAM at 2,133 by default, and unless you're trying to squeeze out every last bit of juice, stock speeds usually suffice. If we wanted faster memory, we'd probably go with 2,666. This mobo has eight DIMM slots, so there's room to add more, but 16GB is a good start.

For more of our component recommendations, visit www.maximumpc.com/best-of-the-best.

UPGRADE OF THE MONTH

EK VARDAR F4-120 120MM FAN

We used three 120mm Vardar fans in this month's "Build It" to keep a pair of GTX 980 Ti's cool, and several larger models for the Dream Machine's radiators. A bit on the loud side at 33.5dBA, these babies push more than 77 cubic feet of air per minute (cfm) and a static pressure of 31Pa when spinning at 2,200 RPM. In comparison, Corsair's SP120 fans push 57.24cfm and 15.6Pa at 1,550 RPM.

$18, www.ekwb.com

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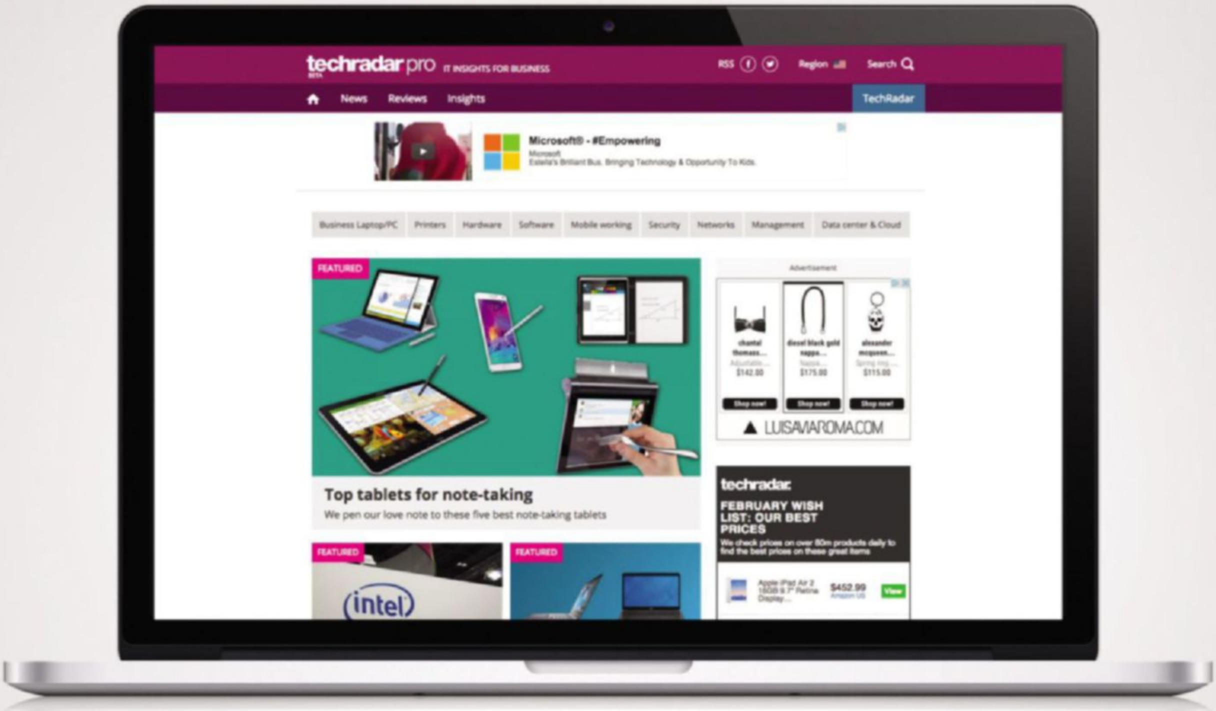
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